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SANDAL.

(Continued from page 210).

X. *Mode of Growth.*—The first appearance of Sandal above ground is the elbow of a slender green loop, the cotyledons remaining below the ground folded in the shell of the seed. As soon as the loop unbends, and the cotyledons appear above ground, they are liable to be eaten by insects, and insects continue their attacks most vigorously on the young tender leaves during the first year of the plant's existence. The young Sandal seedling, a few months old, has a tap root comparable to a young radish—a bundle of fibre surrounded by soft cellular tissue. This soft cellular tissue is very liable to be attacked by grubs: I have lost many plants from this cause both amongst *in situ* sowings and amongst nursery plants in pots. During the first year Sandal in nurseries should grow about 10 inches in height, (this is the contract height in the Mysore plantations,) but want of attention in keeping the plant supplied with leaf manure and water will give sickly yellow plants, not more than 4 or 5 inches in height, at the end of the first year. On good soil, in a yard cube pit, Sandal should be from 1 foot to 2 feet in height at the end of the second year from seed; and when planted side by side with Casuarina, the Sandal will occasionally be higher than the Casuarina; but this rapid growth is not maintained beyond the first few years, and there are always considerable differences amongst Sandal trees of the same age and growing side by side. When young, Sandal has to contend with many enemies, and at the end of two or three years there are more differences in the appearance of the growth than with Casuarinas or Blue-gums at the same age. The smooth succulent character of the leaves of Sandal doubtless contributes to render them the favourite food that they are for hares and deer. When planting Sandal it is usually necessary to place thorns over each plant to keep off hares. If spotted deer are abundant in the locality, it becomes necessary to fence plots of Sandal

planting. Self-sown seedlings excessdal are rarely seen except amongst clumps of thorns or out bushes, where they are naturally protected from browsing.

When grown up out of the reach of hares, deer and (in village grazing grounds) goats, Sandal trees are still too often sufferers by their branches being broken off for fodder.

Compared to Casuarina, or to Teak, Sandal is undoubtedly a slow grower; but in the central hill forests of Mysore it is a fast grower compared to the excessively slow growth of the indigenous species with which it is associated. It has been also observed to shoot up rapidly amongst high forest trees of good growth which exist on the dry side of the zone of coffee cultivation in Mysore; but here again, it has been remarked that after a few years the growth becomes so slow as to be scarcely observable. In 1875 when in charge of the Hassan Forest Division, I cut dates of the year "1875" so as to just pierce the growing cambium layer, on several Sandal trees, near the Forest Lodge, in the Baktarwalli Sandal plantation. I noted the position of these trees, and left directions that they should not be felled. Their age from appearances was near the period of their commercial maturity, a period which I reckon practically as the time when the heartwood comes to within 2 inches of the bark, in an old looking standing tree, or more exactly, in a cut tree, when the proportion of heartwood to sapwood is as 4 : 5, measuring the section across an average radius or diameter. I next visited the Baktarwalli plantation in 1882, and found my three trees untouched. The slight wounds made in cutting the date had grown over, but indistinct scars on the bark showed where the bark had been cut. I then made sections with a knife down on to the old wood, when "1875" became clearly visible. The thickness of the superimposed layers, and of the surrounding layers of tissue, which scarcely differed, was then measured, with the following result, transcribed from an official report made at the time :—

In tree No. 1, large but still in vigorous growth, the average thickness of the new formation of wood was 0·10 inch.

In tree No. 2, which in size and apparent age, was very similar to No. 1, the average thickness of new formation of wood was 0·11 inch.

In tree No. 3, which was situated close to No. 2, but which was older and evidently making little growth, the average thickness of the new growth of wood was only 0·06 inch.

Thus for two trees apparently in full growth, but approaching maturity, the average increase in diameter per year per tree was only $\frac{0''\cdot10 + 0''\cdot11 \times 2}{6 \times 2} = \frac{0''\cdot21}{6} = 0''\cdot035$. For a tree already mature the same figure was only $\frac{0\cdot06 \times 2}{6} = 0''\cdot02$. This last tree is an example of the loss resulting from leaving a mature

tree standing. During the last 6 years the addition to the diameter of the tree was only 0·12 inch, *i. e.*, the growth was practically nil ; but the loss, represented by the forfeited interest (at 5 per cent.) of an unemployed capital (assuming the tree to be worth Rs. 30 as it stood), would be Rs. 14. For a graphical representation of this loss on an acre supposed to be fully stocked with Sandal, *vide* "Indian Forester," Vol. III., No. 4 of 1878.

Until within the last three years the Sandal plantations in Mysore were stocked by *in situ* sowings in shallow pits. As will be explained subsequently, the resulting stock was too irregular to furnish figures of growth, and the only accurate information in my possession on the rate of growth of Sandal is that which I obtained on enquiring into the history of certain individual trees, in prominent positions, near some villages, where I happened to be encamped some years ago with spare time on my hands. The results of this enquiry were published in the "Indian Forester" in the paper mentioned above. In that enquiry the history and age of 15 isolated Sandal trees were minutely recorded, and calculation made of the different ages at which these trees would be mature supposing them felled—

1*st*, at the period of their commercial maturity ;
2*nd*, " " " physical maturity.

The enquiry was made with the object of obtaining some information on the commercial and physical maturities of Sandal, and the data are not sufficient to determine the cubic content of the heartwood, and consequently the rate of growth, for more than 12 trees. The individual-increment for these 12 trees is 0·141 cubic foot as follows :—

Individual-increment of 12 Sandal trees grown in the Hassan District of Mysore : elevation 3,000 feet : rainfall 35 inches.

No. of case in paper "Notes on Sandal."	Cubic content of heartwood in cubic feet per tree.	Age of trees up to commercial maturity.	Individual-increment in cubic feet per year.
1	2·11	40	0·053
3	1·73	43	0·040
4	10·44	55	0·190
5	10·34	35	0·295
6	2·96	28	0·106
8	7·21	50	0·144
Mean allowing for the number of trees in each case,	...	...	0·141

Leaving out the trees in cases (1), (3) and (6), which were bad specimens, the individual-increment for the remainder is 0·166 cubic foot. Probably, till more figures are available, 0·15 cubic foot per annum may be taken as the bulk of Sandal formed by a tree in good growth, and cropped at the period of its commercial maturity. In the above calculations sapwood and bark are left entirely out of consideration.

Artificial propagation.—From 1868 to 1878 the artificial propagation of Sandal in Mysore was exclusively by means of direct, or *in situ*, sowings; and it was not until the introduction of tile-pot nurseries, that regular planting was attended with any certainty of success. *In situ* sowings, as regards the percentage of established plants, gave the poorest results, but by going over the same ground for 6 or 8 years in succession, a stock was eventually established, and there are now in Mysore about half a dozen Sandal plantations, which were formed in this way, and which are now more or less completely stocked: there is about an equal number where *in situ* sowings, continued for several years and giving purely negative results, was eventually abandoned. In the drier eastern climates of Mysore, *in situ* sowings of Sandal have failed, equally with that of every other species which has been tried, and almost every indigenous tree of value *has* been tried. In low-lying arable land, which can be repeatedly ploughed, trees can be easily raised from *in situ* sowings, though the after-growth is poor and scrub-like; but the forester's place in Mysore is among the stony ranges of hills which intersect the plateau at all points, and here, with *in situ* sowings, the best results have been obtained by putting seed in small patches dug to a depth of 8 or 10 inches. It is preferable to have the patches as close as possible, on account of the small percentage of patches which will remain finally stocked; and the more the patch of worked soil approaches a foot cube pit, the greater will be the percentage of established plants. Pits of any size for *in situ* sowings would be casting pearls before swine. But without pits, the mere sowing of seed in patches, is such a simple and inexpensive process, (usual rate 400 patches per rupee,) that it naturally commended itself from the first to the attention of foresters in Mysore, and received a thorough and conscientious trial. The results were these—

In the large plantations to the north and east of Bangalore, on flat scrub-covered land, *in situ* sowings of species indigenous and exotic were definitively abandoned after three or four years thorough trial. These trials were resumed by me in 1877 and 1878, with a variety of precautions too numerous to mention here, and the result was that *in situ* sowing was finally and definitively abandoned. In these experiments Sandal was sown in the open and under shade, in patches, and in pits of all sizes up to the standard yard cube pit.

In the central hill forests the result of *in situ* sowing of

Sandal and other species was substantially the same, except that where there was more shade the germination was better. But there was no improvement in the percentage of established plants, apart from a few exceptional cases, where there happened to be a good supply of sub-soil moisture.

In the western Sandal zone, where the early rains are heavier, *in situ* sowings have the best chance of success. In two plantations in the Hassan District, Ijapur and Baktarwalli, where the success of *in situ* sowings was sufficient for the system to be continued for nine years, the following results were reported by me, on visiting these plantations recently.

Extract from an official Report to the Dewan of Mysore, dated August 1881 :—

* * * * * *

" Sandal sowings have been practised at the Ijapur and Baktarwalli plantations for the last nine years. Year after year the old ground has been re-trod with a hopeful persistency similar to that with which Amildars enter on work of this description. The nett result is, that Rs. 9,589 have been spent, and that 3 per cent. is a liberal estimate of the number of patches which contain seedlings. Of these 3 per cent., more than half are of a size smaller than the ordinary one year old plants from a tile-pot nursery. Mr. Stephens, the local Forest Officer, agrees with me in thinking that 2 per cent. at Ijapur and 4 per cent. at Baktarwalli, represent the average percentage of patches with seedlings in them. We have spent four days in examining this work. On taking charge he wisely stopped further expenditure on Sandal sowings. I should add, that of its kind, there is no fault to find with the work that has been done. I was gratified to find the sowings for this year in such a forward state. Financially too, this Rs. 9,589 has not been thrown away : 3 per cent. on 181,500 patches gives 5,445 trees, and Mr. Stephens informs me that he at one time counted 50,000 trees at Baktarwalli. There is about 15 acres there on the top and side of a hill where the Sandal looks well. Both these sites are within the influence of the beneficent early rains of the south-west monsoon, and Baktarwalli is good high-timber hill forest. The rate for patches, stated now to be 550 per rupee, is moderate ; but the work not having been regular, nor charged rateably, the old accounts cannot be verified. Thus the result of *in situ* sowings, carefully conducted for nine years, is a success of $\frac{4}{9} = 0{\cdot}44$ per cent. per annum on a good soil (Baktarwalli): on the poor soil of the Ijapur reserve $\frac{2}{9} = 0{\cdot}22$ per cent. per annum.

* * * * *

The following extract from the same inspection report relates to the Naihalla Sandal plantation, and is an example of the best results attained from the *in situ* sowings of Sandal in Mysore :—

" *Naihalla Sandal Reserve near Bettadpur, Ashtagram Division.*— This plantation has been stocked exclusively by *in situ* sowings, as have Baktarwalli and Ijapur; but the patches have been made twice as close (a yard apart here) and more seed put in each patch. Still

more seed than has been used here would have been better—see my Forest Notes. More favorably situated for supervision, the Sandal at Naihalla presents a far better appearance than the similar tracts in the Hassan District. On entering the enclosure, Sandal is observable everywhere, from the weakly seedlings of last year, carrying on a very unequal struggle with the prolonged drought of the present season, to strong trees 10 and 15 feet high. As elsewhere, the best trees are in the clumps of thorns and bushes.

The following are percentages of stocked patches, counted at intervals as I walked through the plantation:—

Percentage enumeration at Naihalla.

Brought forward,	149	254	
10	8	5	
40	40	12	
12	12	3	
8	6	10	
6	3	9	
3	6	8	
8	6	11	
4	5	6	
8	6	7	
20	4	7	
22	5	6	
8	4	4	
149	254	36) 342	Total.
		6) 9·5	
		Mean 1·6	per cent. per year of patches stocked.

It will be observed that there are considerable variations, and that on an average 9·5 per cent. of the patches are stocked. The work has been repeated here for six years, so that the yearly percentage of the successfully stocked pits is 1·6. This, for *in situ* sowings on a poor soil, is a very fair result. The work appears to have been creditably done, but not rateably: and there is no information with regard to rates available in the Mysore District office. The plantation was begun in 1875, and I have the expenditure on it each year since; but there having been no working-plan, it cannot be stated exactly what area has each year been treated. The area of the plantation is *considered* to be 96 acres: the total expenditure has been Rs. 4,433, or at the rate of Rs. 46-2-10 per acre. This, considering that the area carries a fair stock of Sandal, is not a high rate—considerably

less I believe than what the same description of work has cost the Madras Government. If 9 5 per cent. of the patches are stocked, there are now just under 4½ lakhs of young Sandal trees in the plantation. Assuming the stock complete, and that 300 trees per acre come to maturity, the present selling value (discounting at 5 per cent. compound interest, taking the maturity at 45 years and the nett value 45 years hence per tree at Rs. 50) would be Rs. 1,78,560. Rs. 50 as the nett value of a forest-grown Sandal tree is a safe estimate, Rs. 30 being the nett average value of a Sandal tree grown in both favorable and unfavorable localities. The only doubtful figure in this estimate is the maturity period. If this extends to 60 years, as some of my enquiries seem to indicate, the discounted present value would fall to rather under a lakh of rupees. In considering the future fire-protection of this plantation, it must be remembered that its discounted *present* value cannot be much less than, and may considerably exceed, a lakh of rupees; and that for some years to come a bad fire would destroy nearly the whole of the Sandal. The stock, worth about a lakh now, will be worth about two lakhs in 15 years, but by that time many of the Sandal trees will be of a size to be badly injured, but not killed by one fire. Thus, as the value of the stock increases, the disastrous effects of a fire would become less, but the latter will not keep pace with the former, and until the plantation is of an age to admit of cattle being turned in in order to get rid of the grass, no pains should be spared to secure it from fire."

* * * * * *

Of the heads given under *in situ* sowings, (1) and (2) have been discussed. As regards (3), the best time for *in situ* sowings is the beginning of the monsoon, as soon as the early south-west showers have moistened the ground. The western Sandal zone has this advantage over the central hill forests and the scrubs, that the early rains from the south-west monsoon are usually sufficient to ensure the germination of seed; and thus the resulting seedlings are five or six months old when the dry season sets in. But in the other two classes of forests, there may not be sufficient continuous rain to germinate Sandal until the autumn, so that the dry season finds seedlings two months old and kills them in a fortnight—in the open. Sandal seed, sown in patches, is very liable to be eaten by rats and insects, especially in the eastern forests, where the germination is delayed and uncertain. I have combated this by soaking the seed in sulphate of copper and assafœtida.

(4), A Sandal plant which has withstood one dry season is very unlikely to perish the second, because, if unwatered after one dry season, it is an established plant with a long tap root.

Several weedings of a light description are necessary in the western Sandal zone. In the other two classes of forests, weeding is unnecessary, or is limited to once inverting the sod of grass which may form round the young plant.

Watering.—Watering, whether in the case of planting or of

in situ sowing, is impracticable in Mysore, except on the most limited scale. Watering is the kernel of the whole matter of artificial propagation in a dry climate like that of Mysore. The successful system of planting which has been followed in Mysore for some years, hinges on the fact that it has enabled us to do *without watering*. *With* watering any system of planting or of *in situ* sowings will succeed; it is "gardening" as distinguished from "forestry." Watering in a dry climate is equivalent to hot house culture in a cold climate. I have seen so-called experimental plantations which were really gardens; there was a staff of gardeners, and each gardener had so many plants which he visited and hand-watered daily.

Now, in Mysore, it is generally extremely difficult to get a sufficient supply of water for even the nurseries if they are on a large scale. An ordinary well will not yield an unfailing supply of water for more than 30,000 closely packed tile-pots; and the digging of a well is always an uncertain operation. If one is fortunate enough not to encounter stone, the well may have to go 60 feet into the loam before water is reached. Nursery wells of this depth are of course impracticable: a nursery well is usually stopped when a depth of 30 or 40 feet has been reached without finding water. A fresh site for the nursery has to be then looked for. Over a large area of the western teak forests of Mysore, the sub-soil water is at such a depth as to render well digging impracticable. Here, for want of water, nurseries are almost impossible, except near a few streams. Watering transplants is of course quite out of the question. In the open plains, where there is more sub-soil water *in the dry season*, it is safest, where practicable, to locate the well and nursery within the influence of a large tank. Except near very large tanks the finding of an unfailing supply of water for the nurseries is always extremely difficult; so difficult is it that in the choice of sites for nurseries every consideration has to give way to that of the water supply. A curious fact may be mentioned here, namely, that in the immediate vicinity of the old established Casuarina plantations, it is more difficult to get water by well digging, than in the open plain country around; and the same observation has been made with regard to the Cantonment of Bangalore, where a large quantity of Casuarina and other evergreen trees have been planted. As the evergreen trees have grown up the well water level has sunk. With these remarks, I proceed to describe the system of planting which has been perfected in Mysore for Casuarina, and which has been found to be the only system applicable to the planting of Sandal on a large scale, Sandal being a difficult tree to transplant, and one which during many years it was declared could not be planted. The essential points of this system are, that the plants are raised in tile-pots, whence they are put out in yard cube pits *without disturbing the roots*. The planting out is thus merely a continuation of the

plant's life in the nursery. The planting out is done during the early monsoon. As soon as the rains have set in, the plant is transferred from its tile-pot in the nursery to its cubic yard of freshly filled-in earth in the plantation. It then grows rapidly, *with a deep root-growth*, during the monsoon rains; and the first hot weather finds it with its tap root more than 3 feet below the surface, and thus almost comparatively out of the reach of drought.

The tile-pot is formed by placing two semi-cylindrical country tiles together edge to edge, so as to form a cylinder, about 5 inches in diameter and 10 inches long. The cylinders are placed together side by side in previously excavated beds, till they form a honeycomb filling the bed. Earth is then shovelled into the honeycomb of tile-pots, filling the whole up flush with the surface of the ground. To facilitate counting, each bed usually contains 100 tile-pots—10 rows of tile-pots, 10 in a row. The beds of tile-pots are separated only by narrow paths, just wide enough to permit the formation of the channels by means of which the beds are irrigated, the water being raised from the well by a pecotah. It matters little whether the seed is sown broad-cast over the beds of tile-pots, or pricked out into the tile-pots from little beds of sand, which are convenient for germinating seed. The former course is usually adopted with Sandal, it being extremely sensitive to removal; while Casuarina is germinated in beds of sand, and pricked out into the tile-pots when it is from 1 inch to 2 inches in height. The price of common roofing tiles in Mysore, such as are used to make the tile-pots, is from Rs. 4 to Rs. 5 per 1,000 cylinders or pairs of tiles; each pair of tiles making a cylinder or one tile-pot. When the system of planting from tile-pots was first introduced, the two tiles were tied together with string, grass, &c., but this was soon found to be unnecessary. The earth in the tile-pots, during the six months or a year that it remains in the nursery, necessarily cakes to some extent with the constant watering, and the plant becomes also what gardeners call "potbound;" so that when the transplants are removed from the nursery, the plant, rooted in its cylinder of earth with the tiles enclosing the earth, comes out in one piece. The tiles adhere sometimes so firmly that it is difficult to remove them from the cylinder of earth without breaking them; but usually one of the tiles can be easily lifted off, or it will come off with a little tapping and coaxing with a stick. The nursery cylinder of earth, supported on the remaining tile, is then put into the hole in the ground prepared for it, the pit earth pressed firmly round, the remaining tile withdrawn, and the transplanting is done. Sometimes the cylinder of earth from the nursery is so hard that both tiles can be removed without fear of breaking it: the nursery cylinder of earth then goes into the ground without having a pebble shaken. This may be regarded as the perfection of

planting; it usually occurs during a spell of dry weather, that is to say, exactly when good planting is most required.

In large forests, where bamboos are abundant and potters scarce, tile-pots are economically replaced by bamboo pots. The two advantages appertaining to the use of pots in dry climates are—1*st*, the saving in the area of the nursery; this is a consideration when watering is reckoned at so many square yards per rupee per month; 2*nd*, the ease with which the cylinder of earth can be extracted from the nursery—a cylinder, small in diameter but deep, and in which the root, confined at the side, has already taken a deep development.

In introducing tile-pots in planting operations, the cost of the tile-pots has to be set against a saving under these heads —1*st*, in the cost of watering the nursery; 2*nd*, in the cost of carving out with spuds, the large cylinders of earth surrounding the roots when the latter are left unconfined in the nursery;* 3*rd*, in the reduced cost of carriage from nursery to plantation; eight plants in tile-pots weigh no more than two with large cylinders of earth carved out of the nursery which was the old system of transplanting. Tile-pots cost from Rs. 4-8 to Rs. 5-8 in Mysore delivered on the nursery, free of breakages. The average life of a good tile-pot is 5 years. The total saving in the cost of planting after the introduction of tile-pots in Mysore was Rs. 15 per 1,000 plants transplanted. We may reckon the cost of tile-pots per annum at about one rupee per 1,000. Thus the nett saving, by the use of tile-pots, was Rs. 14 per 1,000 transplants.

The essential conditions for successful planting in a dry climate seem to be—to encourage and to protect the tap root while in the nursery, and to plant it out in a large pit of freshly dug earth as soon as there is sufficient rain to moisten this earth. In a dry climate we plant *with* the tap root; in a moist or in a temperate climate one cuts off the tap root to avoid the trouble of caring for it, and planting is done with the superficial fibrous roots which replace the cut tap root. With Sandal, as I have already remarked, there is no choice about accepting or cutting the tap root. The young Sandal seedling from the time it germinates is difficult of removal; and to injure the tap root in the smallest degree is to kill the plant. In the Sandal nurseries it is usual to strew a layer of broken bits of old tiles at the bottom of the beds, and on this is set the honeycomb of tile-cylinders, so that any unusually long tap root passing downwards cannot grow beyond the tiles.

Sandal seed is sown in the nurseries as soon as the tiles are emptied of the previous year's plants. A dozen or more seeds

* This "carving out," including the cost of the entire process of lifting up the plants out of the beds, need not cost, if proper implements are used and the daily wage of a man does not exceed 4 annas, more than Rs 2 *per mille*.—[ED].

should be put in each tile-pot, or the seed may be sown broadcast and thickly over the honeycomb of pots. The seed is then lightly sprinkled with loose earth, and over this is strewn a layer of old leaves, grass, or other half decayed vegetable refuse, which must be renewed constantly during the ten months or a year that the Sandal plants remain in the nursery. This vegetable layer should never be less than an inch thick. The seed will germinate slowly, and fresh seed must be put in till every tile-pot has a little bunch of Sandal seedlings. Any tile-pots still left empty may be stocked by very carefully pricking out seedlings. In spells of dry weather, during the monsoon, water must be given *sparingly*. Anything approaching a swampy condition of the nursery will damp off the seedlings. If the locality becomes flooded during heavy rains, as of course must happen sometimes near tanks, the only remedy is to lift up the tile-pots from the beds, and set them side by side, to dry in the air. This entails trouble and expense, and the flooding of a Sandal nursery is undoubtedly a calamity to be foreseen and provided against in choosing the nursery site. The rains over and watering in full operation, which usually occurs about the beginning of December, a light shade of boughs should be put up over the Sandal nursery: a shade which will stop less than one-half the direct sun light at midday is preferable. Too much or too little shade, or too much watering, will render the young Sandal plants liable to suffer from leaf disease. Leaf disease sometimes commits great havoc in Sandal nurseries. The leaves turn yellow, and drop off one by one from below upwards. The Sandal plant becomes a bare stick with a struggling terminal bud, and is thereby retarded in its growth if it is not killed outright. Leaf disease may occur at any time, but it is most to be feared towards the end of the young Sandal plant's sojourn in the nursery just as the monsoon is setting in. I know of no remedy for it except attention and care on the part of those in charge of the nursery. If the soil of the nursery gets into bad condition, caked at the surface, or sodden either from careless watering or inattention to the constant renewal of the surface layer of leaf manure, leaf disease will invariably make its appearance. The three things to be especially borne in mind in a Sandal nursery are—1*st*, light watering; 2*nd*, light shade; 3*rd*, the maintenance of the layer of leaf manure by renewal every two or three weeks. Healthy Sandal should grow at the rate of nearly an inch a month while in the nursery, and be thus a strong plant about 8 inches high, with a tap root 10 inches length when the monsoon sets in, and it has become time to put out the transplants from the nursery into the pits which have been prepared for them in the plantation. It remains now to speak of pits.

The use of large pits in planting is common amongst the natives of Southern India, where occur wide plains of indurated

loams characterized by low sub-soil moisture. These loams abound in iron; they are an intimate mixture of clay and sand such as is employed in plastering and brick making: more clay would make them crack in the dry season and swell up in the wet; less clay would prevent them binding. Tropical sun and rains do the rest, and the result is a soil as hard as a macadamized road during nine-tenths of the year. To break up this hard layer for planting, we must employ either *very* deep ploughing, or the simple expedient of digging a pit and filling in the earth again. A Forester has little to do with ploughing (unless he poaches on arable land), hence, if he is a planter on these hard plains, he is a great digger of pits, and if he wishes to avoid watering, he digs a deep pit. A cheap and simple steam-digger is a desideratum, though it is difficult to imagine any machine able to compete with the cheapness of manual labour and the dearness of fuel. Mr. Robertson of the Madras Agricultural Department speaks very hopefully of an American digger lately introduced. I have tried experiments with blasting pits, and with pits formed by driving in steel tubes with a mallet. The first plan is expensive, and has other and obvious objections. The second requires further experiments with tubes increasing in size; pits so formed would be too small for Casuarina, but large enough for Sandal.* But it is difficult to imagine any improvement where yard cube pits can be dug at the rate of 32 cubic yards per rupee, which is the common monsoon rate in the large Casuarina plantations in Mysore. I have on several occasions made experiments, and lately on a large scale, in order to determine whether the yard cube pit is really the most economical size that could be adopted. Pits of different sizes were dug in compartments lying side by side in the same plantation. These compartments were planted up in the same manner and the results watched. To the digger the advantage of the yard cube size of pit is, that the coolie gets into the pit and digs it out large and square at the bottom, exactly where it is most important for root development that the pit should be roomy. Casuarina is such a rapid and greedy grower, that up to 4 or 5 feet cube "the larger the pit the larger the tree" is a rule which is strictly true. To dig pits on a large scale, bigger than a yard cube, is impracticable on account of the expense; but it appears to be false economy to attempt to reduce the pit below a yard cube in size in the case of Casuarina on hard loams. For Sandal, which has a much slower growth than Casuarina, the most economical size of pit appears to be one 2 feet cube or 2½ feet cube according to the cost of digging the pits. But pits of this size are in disfavour with the coolies and pit contractors, and in the only

* We should say that the stronger kinds of soil borers used by foresters in Germany would do the work expeditiously and at a trifling cost.—[ED.]

locality in Mysore where Sandal planting has been prosecuted on a large scale, Sandal and Casuarina are planted side by side, so that it would cause confusion to have two sizes of pits. Thus almost the whole of the Sandal planting which has been done in Mysore is in yard cube pits. In these plantations Casuarina is planted now 9′ × 9′. The early planting of Casuarina alone, by Major van Someren and Mr. King, was 15′ × 15′, and this, which has been recently measured, has given surprisingly favourable rates of average growth, both per acre per annum and per annum per average tree. The advantage of the closer planting is that it lessens the danger from fire in a mixed plantation of two species so extremely sensitive to fire, as are both Casuarina and Sandal. I anticipate that such of the present 9′ × 9′ planting as is available for measurement 7 years hence, will give a higher acre-increment, but a lower individual-increment than the old wide 15′ × 15′ planting. For a mixed plantation of Casuarina and Sandal I should consider 9′ × 9′ as the most favourable distance for planting.

If yard cube pits are spaced 9′ × 9′ they have the advantage that the space left from pit edge to pit edge being only 2 yards, is nearly covered by the soil excavated from the yard cube pit. With a very little extra trouble, all intervening ground between the pits may be covered with the earth thrown out of the pits, and the old grass covered and killed. Thus, afterwards, when these pits are filled in for transplanting, the soil around the young trees is clean, which of course is an advantage with all trees, and, with a rapid grower like Casuarina, helps the early suppression of the grass. It should perhaps be added, that pits in the Mysore plantations are dug as labour offers and when the ground is favourable for pitting; there is thus necessarily almost always a large balance of empty pits on hand, and it is an advantage that the soil excavated from the pit should remain for some time exposed to the atmosphere. But before working-plans were introduced, this large balance of empty pits was one terrible source of confusion. Sandal as has been already noticed, should not be planted pure, but mixed with some good shade-giving species—*1st*, because Sandal is a shade-lover, and a lover of more shade than is afforded by its own leafage; *2nd*, it flourishes best in a vegetable soil which its own foliage is not capable alone of forming; *3rd*, it requires shelter when young; *4th*, there is the doubtful quality of root parisitism.

Glancing through the heads under which information has been asked, there remains little to be added under Sandal planting.

With regard to weeding, what has been said under *in situ* sowings applies equally to planting. Light weedings are necessary for a few years in the western Sandal zone; in the central hill forests and in the scrubs no weeding is necessary, or weeding need not extend beyond raising and inverting the sod, which may have formed and filled up to the surface of the pit

around the transplant. A sod raised with a spade or a monati, and replaced roots uppermost, takes a year or two to decay, and in the meantime keeps clean the ground so covered.

Watering for plantations on a large scale, as has been remarked, is only practicable for a short time, and very partially during the monsoon rains, and until the plants are established. Putting pits against watering, pits have the advantage (and it is an inestimable one in large operations) that pitted areas can be immediately checked with the compartment areas borne on the working-plan. Watering on the other hand is a loose operation, which cannot be checked on a large scale. Secondly, watering brings the young tree's roots to the surface; it is a *demoralizing* operation, which once indulged in must be continued! Pitting on the contrary simply assists nature, encouraging the deep root growth which is characteristic of all trees in a dry climate, especially evergreen trees such as Casuarina and Sandal. In the mixed Casuarina and Sandal plantations in Mysore, watering has been entirely abandoned for many years. The area of these plantations up to the end of 1881 was 3,872 acres, or 6 square miles. "Repairs" or "replacing failures," with an average season and average soil, does not exceed 15 per cent., and the rate for replacing failures is a very low one, namely 270 per rupee, since all that is necessary is to place a second plant in the pit where a previous one had failed.

As with *in situ* sowings, the first hot weather is the critical period. The planting is considered to be established when the first hot weather is passed, *i.e.*, after the transplants have been about a year in the ground.

Sandal sowings have been tried with gingelly (*Sesamum orientale*), castor oil (*Ricinus communis*), and with other plants as nurses, but the results were not sufficiently favourable to invite a repetition of the experiments. Doubtless the shade afforded by these plants as nurses is beneficial to the Sandal; but the drain on plant food and on sub-soil moisture is similar to that of very energetic weeds. Even a few castor oil plants, which were raised recently for shade in a tile-pot nursery, were found to injure the growth of the Sandal near them.

Sandal cannot be propagated from cuttings: root cuttings, which would seem likely to succeed, are in practice a failure. To this account of Sandal planting in Mysore, is appended a copy of rates* current, and of the planting rules* or conditions, handed to each contract mistri, when he is employed. It should be stated that all work is done on contract, at the maximum rates here shown; it is measured up and passed monthly by the Ranger in charge, and checked by working-plans, in which each plantation is divided into blocks and compartments, the

* These unfortunately have not survived the voyage to the Southern Hemisphere, which was the fate of this paper after it was written.

quantity of work charged in a compartment being checked against its survey area : the nature and progress of work is shown on the working-plans by colouring—yellow for pitting, green for transplanting, dull red for areas too rocky to pit, &c.

Planting is being done now in nearly equal proportions of Sandal and Casuarina : Sandal takes the larger share of the planting, as there is much sparse Casuarina, which can be filled in with Sandal, at an enormous enhancement of the value of the stock. There are slightly under four lakhs of tile-pots in the various nurseries in Mysore, and planting in an average season progresses at the rate of between two or three lakhs of transplants.

D. E. HUTCHINS.

The following note just received from Mr. A. E. Lowrie, Assistant Conservator in charge of the Ajmere forests, supplies most interesting information, and makes a very substantial addition to the life-history of the Sandal given by our distant friend Mr. Hutchins :—

"Last year I noticed some (to me) strange looking trees in the Nág Pahár and Mohwa Bír blocks near Ajmere, but took no trouble then to find out what they were. But recently, seeing how well they were getting on in spite of the severe drought this year, I concluded that they would be useful trees to grow in suitable localities throughout the Ajmere forests, and so I set about determining the species to which they belonged. No flowers and fruit being obtainable at this season, and the old leaves being shed while the new flush is only just coming on, the only certain means of identification left for me was to fell one of the trees and examine the wood. I accordingly selected one that was 23 inches in girth. The section showed a core of heart-wood 4 inches in diameter, which gave out the unmistakeable odour of Sandal.

"This was a very interesting discovery. On going over the ground and making enquiries of people able to afford information, I find that there is a small area in each of the above-mentioned blocks, which was formerly a garden, and in which a few Sandal trees were planted some 20 or 30 years ago. These have now grown up and seed profusely every year. The seeds get carried away into the forest by birds and bats, and many seedlings (about 400) of various sizes have been springing up in the midst of bushes, some of them already over-topping these latter. It is a noteworthy fact that some of these seedlings have come up in the driest localities with barely a foot of soil over the underlying quartzite. All the seedlings have an exceedingly healthy appearance.

"In the case of only a single pole have I been able to collect certain data regarding its age and rate of growth. It is 12 feet high, 9 inches in girth and 8 years old. It is growing right in front of the Mohwa Bír Chauki in very poor and rocky soil, but has had the benefit of a little watering from time to time.

"I am informed that the Sandal here flowers early in May, when the new flush of leaves is well advanced."

THE SANDAL WOOD OIL STILLS OF SOUTH CANARA.

THE distilling of sandal wood oil is an industry of very long standing in the Udipi táluq of the South Canara District, but no attempt appears to have been made to bring it under control or secure a revenue from the firewood made use of until 1854. The arrangements then made by the Forest Department were continued till 1874, when they were held in abeyance until 1881, pending the enquiries then instituted regarding the respective rights of Government and private proprietors over the South Canara forests.

The manufacture of the oil did not, however, cease, but a legitimate revenue was lost to Government, and the forests were being rapidly destroyed for want of proper regulations and practical measures of conservancy. During this period the stills were scattered about all along the foot of the ghâts, and there was a great opening for smuggling of sandal wood from Mysore and Coorg. Now they are in a compact block in the villages of Andár and Mutlapádi, and every precaution is being taken to protect and improve the forests by defining the areas and working them in rotation, and to guard against any smuggling of sandal wood from Mysore, on detection of any part or connivance in which, the license to manufacture is liable to be immediately cancelled.

A recent inspection enables me to give the following information as to the method of manufacture, which may be found interesting by readers of the Forester.

The method of manufacture, which is very rude, and might, doubtless, be greatly improved on, is as follows :—

A site having been selected for the stills, a rough shed is erected as protection against sun and rain, and a bank of mud or sun-dried bricks constructed underneath it. Each shed generally contains 12 stills or furnaces, although only 6 are shown in the sketch (*Plate* I).

The sandal wood (roots preferred) is chipped with a small adze (báji) into small pieces and placed in the large earthen pots (A, A, A) at the top of the bank. Each pot is capable of containing two Madras maunds (56 lbs.) of the chips with the necessary amount of water. On the top of the large pot is a smaller one (B, B, B) fitted tight with clay and cloth, so as to exclude the air, from which runs a copper tube (C, C, C) about 1¼ inches in diameter and about 3 feet 8 inches long, the other end of which is placed in the mouth of an empty copper pot suspended in a large wide mouthed earthen vessel 24 inches in diameter placed in the lower part of the earthen bank. This vessel is kept filled with cold water.

The firing is applied from behind the bank underneath the large earthen pots on upper bank (*see Plate* II.), the steam from

SANDAL WOOD OIL STILL.

Front view.

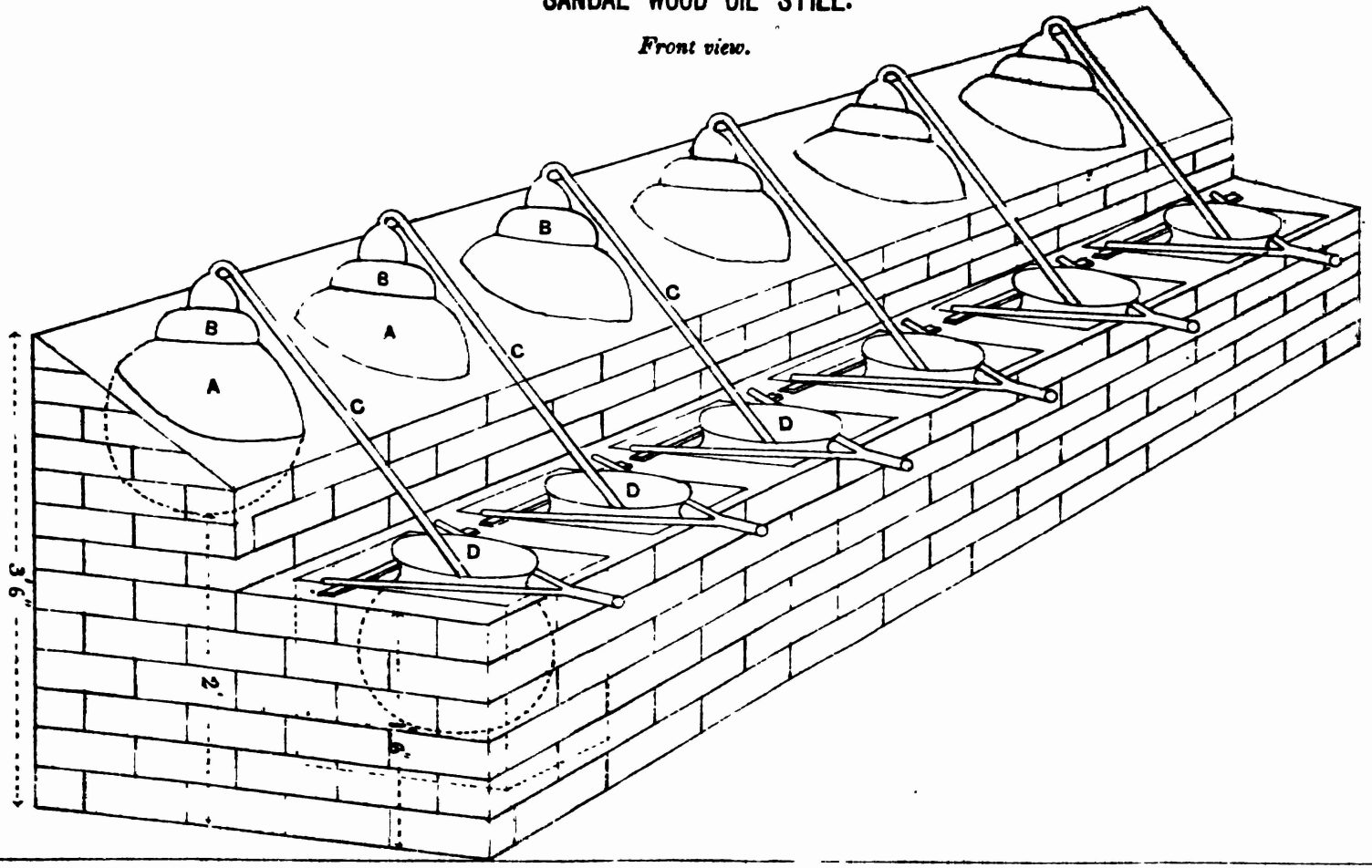

PLATE I.

Litho. T. C. Press, Roorkee

THOS. D. BOSA Supdt

SANDAL WOOD OIL STILL.

Back view.

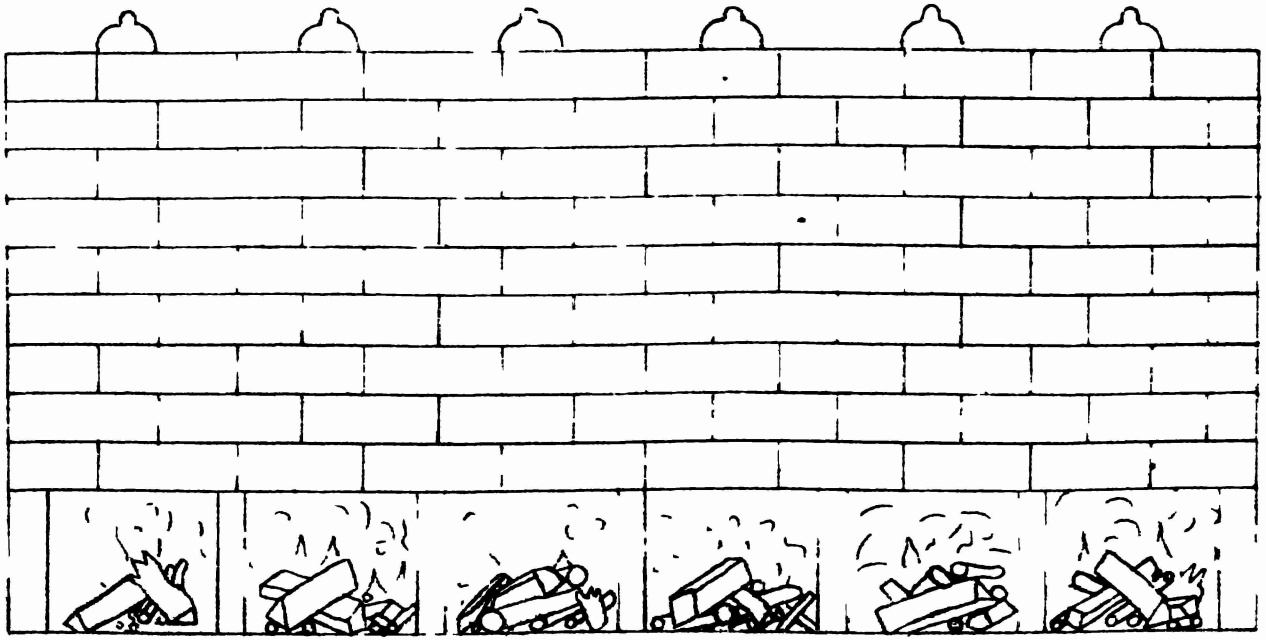

PLATE II.

Litho. T. C. Press. Roorkee.

THO. D. BOSA, Supdt.

which collects in the smaller pot and runs down the copper tube into the copper pot where it is condensed, the cold water surrounding it being renewed as required.

The copper pot (kodapán), which holds about 3 gallons, is supported by a forked piece of wood, which is held in its place by another piece placed transversely across the open earthen receptacle.

The mouths of the copper pots are covered with leaves and coarse grass. As they become filled with water and oil, the latter is skimmed off and emptied into a cistern or shallow tank in the corner of the shed. This is done twice or thrice a day, only a small quantity being obtained each time.

The upper pot holds about 6 gallons of water besides the 56 lbs. of sandal wood chips, which lasts for 21 days, during which the fires are never extinguished.

Immediately one boiling (21 days) is finished, another is commenced.

The working season is supposed to commence on the 1st of August and extend to the 1st of June following, which would be 10 months, but operations rarely commence before the 1st of October, and allowing for holidays, &c., it would not be safe to calculate on a working season of more than 6 months, or nine boilings of 56 lbs. each, representing a consumption of 504 lbs. (18 maunds) per still, or for 1,000 stills, the average number now working, 225 tons of sandal wood per annum.

It is not easy to obtain accurate data as to the outturn of oil per maund or still, but the following is the information given to the District Forest Officer by the Deputy Tahsildar and Haidar Sáhib, the present lessee.

One maund, 28 lbs. of first sort roots produces 2 seers* of oil; 1 maund of second sort, 1½ seers; and of third and fourth sorts from 1¼ to ¾ of a seer.

Haidar Sáhib estimates his average annual outturn per still at 35 seers, 21 lbs. of oil, valued at about Rs. 4-5-0 per seer. Adopting this calculation, the receipts from each still would be Rs. 150-15-0 per annum, or Rs. 1,50,937-8-0 for the 1,000 stills, the total production of oil being 35,000 seers, or 9 tons and 840 lbs.

Most of the oil is, I believe, shipped to Bombay, where it finds a ready market.

As already stated, the sandal wood used in the stills is all obtained from the Mysore plateau above, where the supply of firewood is too limited to admit of manufacture.

The Forest Department in South Canara is, therefore, solely interested in the firewood supply, from which it obtains the revenue, which, when I entered the Department, was credited under sandal wood receipts.

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* A seer = 24 rupees weight.

The furnaces are about 3 feet 6 inches long, and from 1 foot square at orifice to 2 feet further back. They are fed by logs of about 6 inches to 12 inches diameter.

Each still is said to consume two head loads or 112 lbs. per day of 24 hours, which is equivalent to one ton per boiling for each still, or a consumption of 9,000 tons of firewood for the 1,000 stills per annum. We receive Rs. 9 per still, and as all the better descriptions of trees, *viz.*, teak, blackwood, sandal, jack, wild jack, ebony, catechu, poon spar, and cinnamon are reserved, and the rate of production in the moist climate of South Canara cannot be less than a ton per acre per annum on a rotation of 10 years, all we have to secure is an area of 90,000 acres, about 140 square miles, within which the sandal wood still operations should be carried on under proper supervision, the system which recommends itself for adoption being that of coppice with standards.

The forests along the South Canara ghâts can readily supply such an area, and so far from the operations of the stills doing harm, I believe they may be made productive of much good by affording the means of getting rid of the inferior descriptions of trees, whilst supplying the funds for efficient protection and improvement of the timber forests.

The Mysore and Coorg Forest Departments are also to be congratulated on the presence on their frontier of a ready market for so considerable a quantity of sandal wood roots.

In the present depressed state of the sandal wood market, it appears advisable to do everything in our power to develop and extend the distillation of the oil, for which there is, I believe, an all but unlimited demand, and I trust that this description, and the rough sketches made on the spot, may enable forest officers to initiate experiments in distillation in other districts, where there is ample firewood available (under proper management) in the same forests as contain the sandal wood.

OOTACAMUND :
The 20th April, 1884.

I. CAMPBELL-WALKER.

A POINT OF FOREST LAW.

TO THE EDITOR, "INDIAN FORESTER."

SIR,—Here is a point for law students to decide :—

A *náká-kárkun* of the Forest Department is stationed in foreign territory for the purpose of levying fees on head-loads of wood brought from British territory. The *náká-kárkun* is accused by the Range Forester of misappropriating money, and a warrant is issued for his arrest by a Magistrate of a subdivision in British territory, without the previous sanction of the Political Agent to have the case tried in British territory. Before the warrant is out the *kárkun* absconds.

A, B, and C, Clerks in a Divisional office, were soon afterwards convicted of having attempted to cause the disappearance of the *panchnámá* in this case. They were accused by the Range Forester of having gone to him and attempted to induce him, *in British territory*, to tear up the *panchnámá*. The *panchnámá* was of course drawn up on the spot where the offence was alleged to have been committed (in foreign territory). The case against these three men was tried by the Sub-divisional Magistrate, and they were convicted and sentenced to one day's imprisonment, and to pay a fine of Rs. 150 each. The sentence was reversed, on appeal, by the Session's Judge, on the ground that sanction of the Political Agent had not been obtained to try the *kárkun* in British territory, that, therefore, no offence had been committed by the *náká-kárkun* in the eye of the law, and that, consequently, there could have been no attempt to suppress evidence which did not (legally) exist.

What I would like to see explained, is how the illegal proceedings of a Magistrate could affect the legality of evidence which was in no way connected with such proceedings. If the *panchnámá* was producible as evidence in a British Court, it surely was cognizable by that Court, whether certain formalities necessary to bring the case before it had been gone through or not. Consequently, I would say that an attempt to destroy the *panchnámá* in British territory was an attempt to destroy evidence of an offence cognizable by a British Court.

Perhaps one of your readers learned in the law will be so good as to give his opinion.

L. M. G.

Note.—The case seems as if there were something wrong: but it is not so stated that an opinion can be given with certainty: it is not stated under what section of the Indian Penal Code, A, B and C were first convicted: and according to the section charged, so will be the facts necessary to be proved and the legal principles involved. If for instance the accused *abetted* or *attempted* to *abet* the Forest Ranger in committing an offence under section 204, it would be a question whether their going to the Ranger and *proposing to him*, or asking him to tear up a paper which might be lawfully compelled to produce as evidence in Court, is an abetment within the meaning of section 107? If the conviction was under section 201, on the other hand, it was necessary to prove that A, B, C—(1), knew* that "an offence" had been committed; (2), that the "panchnámá" (whatever that may be, its nature, contents, or use, are not explained) was evidence of that offence; (3), that they caused it to disappear; (4), that their act was with the intention of screening the offender from legal punishment. The two latter points are easy to prove, as they are probably inferable from the facts and circumstances, but perhaps the hitch was in (1). Referring to section 40, we learn that "offence" in section 201 means anything punishable under the Code *or* under a special or local law, of such magnitude as to be liable to six months' imprisonment. But A, B, C had knowledge or reason to believe that the kárkun had committed an *offence? i. e.*, an act punishable as stated. If he had committed an act (however gross) which was not *punishable by* the Code, &c., *because such laws were not in force at the place*, then it is possible, the conviction of A, B, C may have been illegal. But this would seem doubtful, for the kárkun is a *British subject* (?) and a servant of the Government, hence by section 8 of the Extradition Act (XXI. of 1879) he would be subject to "the law relating to offences (and to the Criminal Procedure) in force

* "Knew or had reason to believe."

REPORT ON CINCHONA PLANTATIONS IN MADRAS.

TO THE EDITOR, "INDIAN FORESTER."

DEAR SIR,—The critique on the Annual Report of the Nilgiri Cinchona Plantations for 1882-83, which appeared in last month's "Forester" appears to me scarcely fair.

Regret is expressed that Mr. Gass who wrote it did not give the areas of the estates, their position, altitude and past history, but all this information has been repeatedly afforded both in the annual and special reports, and is well known to all those interested in Cinchona on this side of India.

It cannot and ought not to be expected that such information should be repeated in each annual report.*

So with regard to the two Pykara estates, Wood and Hooker. Their situation and extent has been repeatedly described, and it does not to my mind fall within the province of the writer of an annual report to instruct the public in such matters, but to record the progress made and work done during the year under review for the information of Government, who have the necessary information and maps to refer to.

Again as to the experiments in method of barking or taking the crop, the passage regarding which we are told "leaves us quite in the dark as to under which system of barking the trees suffered least" (*sic.*), the writer of the report records what has been done—the results could not be known when he wrote. The Madras Government are finally admonished to furnish clearer reports as to the result of these experiments "showing

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in British India at the time. Hence he would have committed an "offence" by misappropriating or breaking trust regarding the money of the British Government (?) in his hands.

It is true the term "Native Indian subject of Her Majesty" in section 8 (*b*) is not defined, but there could hardly have been a doubt about the kárkun legally answering the description (?) It is true also that the *trial of the kárkun* could not have been held in a British district, unless the Political Agent (if there is one) certified that the "charge is one which ought to have been enquired into in British India." But though the omission to obey the proviso to section 9 of the Act, enabled the kárkun to get off his trial (he could have been re-tried on getting the sanction) that would not affect the knowledge of A, B, C that an offence had been committed. The kárkun's "offence" did not cease to be one, because by omission of a formality, he escaped *trial.* Section 201, obviously contemplates, the *offence* being one *not yet* proved at a trial, since the section is aimed at preventing the disappearance of evidence that may conduce to the (future) proof, &c., conviction of the offence.

In such cases the best thing to do, is to refer the matter at once to the Legal adviser of the Government, so that the Judicial Commissioner or High Court may be asked to exercise their powers of revision.

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* We are still of opinion that Mr. Gass' report might have been made clearer in the way we have suggested, and as these reports are publicly circulated, care should be taken that the progress made may be easily ascertainable without reference to other papers. As regards the results of barking the trees, we must apologise to Mr. Gass for our remarks.—[ED.]

the cost and yield for given areas of land of certain contour and soil." This has been done over and over again, and the writer of the critique should have taken pains to ascertain the facts before arriving at wholesale deductions and giving advice to Government.

During the tenure of office of the late Mr. McIvor as Superintendent of the Government Cinchona plantations on the Nilgiris, there was room to complain that insufficient information was furnished to Government and the public, but such cannot be said of late years when the Forest Department had charge.

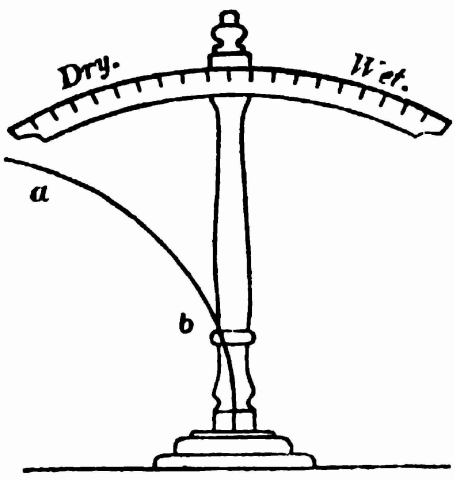
There are reports by the Conservator, Colonel Beddome, by Captain Campbell-Walker, Deputy Conservator, by Colonel Jago, by Committees, and by Doctors Trimen and Lawson, which contain the fullest information.

The Forest Department has now been relieved of the charge of the Cinchona plantation, and the report under comment is the last by a Forest officer which has induced me to write in the interests of

FAIR PLAY.

WEATHER INDICATOR FROM BERMUDA.

The annexed sketch represents a weather indicator or hygroscope which was brought to India from Bermuda. It is very interesting as an illustration of the expansion of wood by moisture.



One-tenth of the natural size.

Two layers of wood are glued together so as to form a thin strip *a b*. One layer to the right is mahogany, with the fibres in the direction from *a* to *b*, and the other layer to the left is pine, with the fibres directed cross ways to *a b*. The total thickness of the combined strip is $\frac{1}{10}$th of an inch, the width $\frac{3}{4}$th of an inch, and the length about 17 inches. The layer of pine wood is twice as thick as the layer of mahogany, making thus the former about $\frac{1}{15}$th and the latter $\frac{1}{30}$th of an inch thick. In average weather the strip is straight. In dry weather it bends to the left as shown in the sketch, and in damp weather it bends to the right. Intermediate degrees of moisture are intended to be read off the scale on the arc which is shown in the sketch. It has been found that in the more extreme climate of Simla, the strip passes at

different seasons quite beyond the limits of the scale which was sufficient at Bermuda.

When the strip stands on the left the radius of the layer of pine wood is about $\frac{1}{200}$th part smaller than that of the mahogany. When the strip has bent over to its extreme position on the right, then the radius of the pine wood is about $\frac{1}{200}$th part larger than that of the mahogany. The difference between the extreme expansion of the pine wood and that of the mahogany is therefore about $\frac{1}{100}$th (linear). If we assume the expansion of the mahogany in the direction of the length of the fibres to be almost nil, this would indicate that the expansion of pine wood across the fibres is about $\frac{1}{100}$th linear from the driest to the dampest season of the year.

Simla, 26th April, 1884. H. WARTH.

FOREST REVENUE CHALANS.

TO THE EDITOR, "INDIAN FORESTER."

SIR,—I am in the Commission of the South-Eastern Provinces and Prod, and have lately been put in charge of a large and important Treasury, into which Forest Revenue is being continually paid in from several districts. I find my ordinary duties quite heavy enough, but latterly an order has issued for Forest officers "not to accept Treasury chalans, the practise and procedure of which they are unfamiliar with, and the signatures of Treasury officers with which they are unacquainted." In consequence I am inundated with letters such as the following. One officer thought the dates were not entered correctly according to Cocker and the A. C. G., another questioned the standard quality of the red ink used in checking the amounts, and a third objected to the style of my writing the figure 9. Again, one wanted to know who my Treasurer was, whether a Mahomedan or Hindu, whether he had eaten rice or dall for his breakfast, and what sort of pen he used; and again one officer wanted to know whether I was Crooks, or Brooks, or Snooks; another, whether I was W. or N. Crooks; and a third whether I would swear I was a relation of old Crooks of——Hall, Dorsetshire. Lastly, two letters, the first requesting me to send my photo. in order that the Forest officer might satisfy himself whether I looked like the sort of man who would sign W. Crooks on his chalan, and the second requesting me to send a statement of my fighting weight, though this latter officer did me the honor to observe, after apologising, that he was not quite sure it was required, but it was better to be on the safe side. The result is I cannot take my evening rides or get my tennis, and I sit wet be-towelled replying to these vexatious queries. Can you do anything to help your

BEWILDERED CROOKS.

REVENUE AND EXPENDITURE OF THE FOREST DEPARTMENT.

The following Table is extracted from the Financial Statement of the Government of India lately published by Sir Auckland Colvin.

	1871-72.	1872-73.	1873-74.	1874-75.	1875-76.	1876-77.	1877-78.	1878-79	1879-80.	1880-81.	1881-82	1882-83.	Revised Estimate 1883-84.	Budget Estimate 1884-85.
	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Revenue, ...	517,664	588,002	639,513	598,367	697,543	616,468	678,699	605,433	676,234	709,320	874,435	938,228	1,009,900	1,053,400
Expenditure, ...	359,451	400,186	403,447	444,021	419,811	458,099	439,938	454,934	465,056	465,976	557,645	567,318	685,000	727,200
Surplus, ...	158,213	187,816	236,066	154,346	277,732	158,369	238,761	150,499	211,178	243,344	316,790	370,910	324,900	326,200

It exhibits the revenue and expenditure under the head 'Forests' for the last 14 years, for the three Presidencies, and is most instructive as showing that in that time forest revenue both *gross* and *net* has doubled itself, the expenditure being also nearly doubled. The average gross revenue has been about £700,000, and the average *net* revenue about £233,000. The average yearly increase has been about £38,000 *gross* and £13,000 *net*. The Table shows clearly the increasing value of 'forests' as one of the important sources of revenue of the State, and there is every reason to think that the figures will go on in the same if not larger proportion in the future.

THE MAIPHAK.*

TO THE EDITOR, "INDIAN FORESTER."

SIR,—At page 119 of the March Number of the 'Forester,' Mr. S. E. Peal writes about the wood of the 'Maiphak' tree of Assam. In his letter he states that a piece of the wood was sent by him and referred to at page xiii of the 'Manual of Indian Timbers.' I have no recollection of the piece having come from Mr. Peal, at any rate directly. It was sent, I believe, to Dr. Brandis by Mr. Mann, the Conservator in Assam.

It is a great pity that instead of sending a rough drawing of an incomplete flower and leaf, Mr. Peal did not send dried specimens, which could have been identified either at Calcutta or Saharanpur, and I hope he will still do so. If he would send specimens to me I should be very glad to endeavour to identify, or obtain the identification of, the species.

In a recent letter from the Assistant Director of the Royal Gardens, Kew, which contains a reminder that such persons as botanists and such places as herbaria exist, whose aid can always be invoked to settle questions of the kind, it is suggested that judging by the imperfect plate and description, the tree is either *Evodia meliæfolia*, Bth. (*see* Flora Indica, i. 490), or something very near it. But only an examination of specimens can decide this, and it is to be hoped that either Mr. Peal or the Conservator in Assam will help to get this done. The Kew authorities also ask for specimens of the wood, and I can only say I shall be very glad to receive specimens also (to be returned to the Forest School Museum) for examination and revised description. I remember the wood specimen of the 'Manual,' No. 3341, well, but have no recollection of Mr. Peal's connection with it.

OOTACAMUND :
May 23rd, 1884.

J. S. GAMBLE.

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* We have heard from Mr. Thiselton Dyer of the Royal Gardens, Kew, that Maiphak is probably a species extremely near to *Evodia meliæfolia*, and have asked Mr. Peal to send botanical specimens to Kew for identification.—[ED.]

II. Reviews.

Mr. MOIR'S REPORT ON THE *CHOS* OF HUSHYÁRPUR (1883).

The Punjab proper is shaped like a large fan, the ribs of which are the five great rivers (with the Indus for a sixth), which entering the northern plains at widely different points along the extended arc of the Himalayan frontier, gradually converge towards their point of meeting in the south. The tract of country between each pair of rivers is called a *Doáb*, and each *doáb* has of course the same generally fan-shaped segmentary form. The smallest, but richest, of these *doábas* is the tract known as *the doába* (*par excellence*) between the Sutlej and the Bias. The "fan" at its angle or southern portion is occupied by the Jalandhar district and the Native State of Kapúrthála, while to the north-west of these and completing the *doáb* lies the district of Hoshyárpur. The district in fact stretches across the whole upper part of the *doáb*, and is bounded in northwards,—so to speak,—by the two rivers suddenly and sharply curving inward, and continuing that direction for a short distance till they again turn towards the hills. The Bias takes this sharp inward (south-easterly) turn opposite Dinanagar: the Sutlej its equally sharp (north-westerly) turn at Anandpur.

The general form of the Hushyárpur district is that of a somewhat narrow strip, lying south-east and north-west.

If we cross the Sutlej from the Amballa district by the ferry at Rupar, we find ourselves soon landed on a good broad country road which runs through the entire district of Hushyárpur from the south-east to north-west. It does not divide the district into equal halves, for it runs (especially at the outset) much nearer to the southern frontier than to the north, but as we commence our journey we observe at hardly a stone's throw from the road a low range of bare hills, apparently formed of sand or clay, not yet hardened into stone. They are of an uniform drab or yellowish color, with the scantiest patches of vegetation, and cut by the rain into every imaginable shape of rugged crest, steep precipice and fantastic peak. The road soon gets further and further from the hills, but they always remain visible on the northern horizon, the hills of the Dhauládár and other Himalayan series, overtopping them as we pass the middle

of the district. After riding along the road, with its shady avenue, for some distance, we find that the road is crossed by a broad band of loose sand, evidently the bed of a river, now dry, and so little below the level of the country, that the descent to it from the road is hardly marked. The bed evidently proceeds from the hills we have been speaking of, and passes away south, towards the Jalandhar district,—how far the eye cannot tell.

The first time we cross the sand, though the horse's hoofs sink into it, and if a breeze is blowing, clouds of fine dust rather annoy the eyes, we do not pay much attention to it: but after perhaps a mile or more, the road is crossed by another, and then another, still broader and more hopeless looking belt of sand, all of them perfectly dry; and then we perceive that these great sand streams—some of them nearly half a mile broad—are a regular feature of the district. Towards the north of the district,—or past the southernmost half of the road, some of the 'beds' are more defined, there is some appearance of banks, the sand is moist in places, and even a sluggish thread of water is visible. Some attempts too have been made here and there to mark the course of the sand torrent by planting barriers of rustling "múnj" grass, which we soon learn is done with a view to prevent the spread of the sand laterally.

A brief reflection on the *tout ensemble* of the situation soon convinces us, that we have here in this rich and fertile district, the frightful defect, that it is from space to space, traversed by a series of sandy belts, each sand bed representing a *strip cut out of the fertile* and crop-bearing total and rendered valueless; —thus reducing the culturable area of the district, by the formidable total of the united areas of all the sand-strips. This is something to regret at any rate. It is also evident that these sand torrents all come from the hill range which we see along the northern frontier, and when we look at their naked and desolate backs, and see how soft and unstable is the stuff of which they are (to a great extent) composed, we cannot but realize, however dimly, that there is "plenty more where that came from." This then suggests that the *Cho* is not an "accomplished fact"—a thing we must put up with; far worse remains behind. The *Cho* has unfortunately (unlike the Euclidian line) both length and breadth, and both are unstable quantities, with an alarming capacity for increase. As to *length*, the traveller naturally speculates—how far south do they go? for there is no river bed running at right angles to them, some distance off, conveniently to stop their career. During every 'rains,' after each heavy fall, every one of these beds, which in our cold weather ride was dry, will become a turbid torrent, the sand brought down by the water will be carried along with much violence: and though it is true that the weight of the suspended sand causes it to fall gradually, still the rush carries

a great deal of it along in spite of gravitation, and as an actual fact the mass of sand is carried further and further south every year, and it is now some time since the Jalandhar cultivators began to cry out, that they too were being invaded by the evil visitors from Hushyárpur.

Then again as to *breadth;* this increases year by year owing to a two-fold agency. Every one who has dipped into Surell's book on Alpine torrents, knows what is meant by the *lit de dejection.* At the point where the *Cho* leaves the hills, it will first of all throw down, all the harder and heavier particles it has carried down with its first fury, and these form a great fan-shaped, heaped up, bed, of somewhat higher level than the rest of the country. Where such a bed comes from a rocky and shaly torrent, it is very highly heaped, as the material is heavy and the wind has no effect on it when once deposited. With the *Chos,* the stuff is sand and marl, (with occasional bits of lime "tufa") so that it gets deposited at a lower angle and the wind also helps to level it: but the mischievous *cone,* if more outspread and less palpable to the eye, is nevertheless surely there; and of course when the next volume of flood water comes down on the top of it, the effect of the cone is to disperse the flow right and left, either in the form of one sheet, or of several diverging streams, the result of which is that the sand is carried out over the country, in a very destructive fashion. When the water subsides and the sand dries up, then the hot winds of May and June send the sand flying and whirling away over the fields to the right and left, and then it is that the poor peasantry begin to plant their tall grass barriers to try and save the fields. Many is the acre of fine sugar-cane land that has been reduced by the sandy deposit to yielding a poor crop of "bherra" (mixed wheat and barley). In the upper part of the district, from Dholbahâ (*e.g.*) and northwards, the *Chos* are less sandy, because the hills are there more formed of pebble conglomerates.

All this then is the evil heritage of that long range of (a sort of Sewalik) hills, which run along the entire length of the district towards its northern frontier from the Sutlej to the Bias.

Not quite on the northern frontier either—for as you stand on the crest of these hills you look down over a strip of Hushyárpur still further north, and hemmed in on its real extreme north line, by the hills of Kangra and Sirmúr, which in their turn are denuded and bare, though of different formation.

A picturesque but rather weird sight it is, this view northwards from the crest of the Siwalik sand hills. The northern slopes are mostly pebble conglomerate, and they send down torrents too. So what with the torrents going north from our Hushyárpur hills and those coming to meet them from the Kangra side, the whole of the northern valley is a mass of pebbles and

boulders, interspersed with *oases* of cultivation; down the middle of the tract runs the so-called "Sohán naddi." It is however with the country *south* of our Hushyárpur hills that we are concerned. The north side would no doubt in time very largely benefit by the afforestation of the hills; but of course till the opposite Kangra hills and those of Sirmúr were also so wooded as to stop the progress of *their* torrents, the Sohán valley could not be completely 'cured.'

Mr. Coldstream, then Deputy Commissioner of Hushyárpur, was the first prominently to call attention to the state of the *Chos*, and in 1878 Mr. Baden-Powell was sent to inspect. His report with illustrations, was re-published in this Journal, and is familiar to our readers. The main conclusions arrived at were, that the evil was not incurable; that the sand, barren as it was when washed and frayed out on the plain, was, *in situ*, and with its occasional beds of clay and with the presence of lime, sufficiently fertile to support a good forest, as well as a herbaceous, growth. The rain fall—over 30 inches—was sufficient, and probably *rest and closure* would naturally restore the vegetation. Mr. Powell discussed the possibility of engineering works, dams and so forth, and such works as the *encrêtement des berges* to aid nature, and suggested at any rate an *experimental closing*. Nothing was done! It would appear however that the objection lay not in the practical or legal difficulties, but in the fact, that whatever the chief authorities might *say*, there was in their hearts a deep-seated *disbelief*—perhaps not acknowledged to themselves even—in the feasibility of any amelioration. It is true that by the mistake of our earlier Settlement officials, the whole area of the hills had been given over as "Shamilât," or common land, to the neighbouring villages, but a short bill in Council would have given the Government power to act. The dislike of special legislation was a mere pretence, in the face of such great and growing evils. If it is not objectionable to pass a special Act to save some debauched and worthless Prince from hopeless debt, is it possible to demur when the object is the welfare of one of the finest districts in the Punjab? Other countries have always allowed special legislation for such objects. The *dunes* in France were taken up and reboised under a special law for example. Then too was all manner of nonsense talked about private enterprise, the people consenting to conserve tracts of their own accord, &c. But to do this, the tracts must be large and continuous, and must be managed by the concurrent action of neighbouring village estates. Imagine the people doing anything of the kind! The experiment has been tried here and there, with the obvious result, that little patches here and there have shown, that the soil *is* capable of restoration, and that private effort here, as it would necessarily be even in the most enlightened districts of Europe, is powerless to cope with a work of such extent.

Moreover, the people who would dislike the closure, would be not so much the owners of the neighbouring villages, as the graziers and squatters.

Then again there was the dislike to interfering with the grazing and wretched patches of cultivation of some 80 or 90 hamlets. Anything for peace and quiet: the whole district might suffer, rather than 'have a row' with these people. The result was that *nothing was done.*

Mr. Powell then appealed, that, if they did not believe him, and moreover, as his was only a preliminary work, a further and detailed examination (accompanied by practical proposals for taking up and reforesting the hills) should be called for. Various officers having visited the spot, and having confirmed the earlier observations, Mr. Moir was at last, in 1882, directed to prepare a further and final report.

We may remark that, had a 'sample area' of considerable extent, where there was least population, been taken up at once (in 1878), and closed absolutely, by this time there would have been a *four or five years'* growth, which on all the evidence available, and in all human probability, would by this time have been such as to afford the most conclusive evidence as to future treatment, to say nothing of *having created a grazing ground* (or rather a grass cutting ground) which might have been of very considerable use in facilitating the disposal of some of the Gújar cattle, that would have to be excluded from the closed area afterwards to be taken up.

Mr. Moir's report together with the letter of Mr. Ribbentrop, Conservator of Forests, forwarding it, and the orders of Government are now published.

The report, which is practical, moderate in tone, concise and well expressed, is full of interest. The map that accompanies it is not indeed very intelligible, and the copy that has reached us, has the color references so given as to make it difficult, if not impossible, to guess what color belongs to which reference. It now appears that more than 780 villages in Hushyárpur, besides what happens in Jalandhar, are affected, and that the recent settlement operations, show the revenue as suffering to the extent of about Rs. 90,000 annually.

We are glad to see that Mr. Moir's proposals are thoroughly practical: they contemplate taking up the tract of country which encloses all the sources of the main *Chos:* thus forming a series of perimeters. These areas are necessarily extensive. Some of them of course are more difficult to get hold of than others, owing to the existence of hamlets and patches of cultivation. Mr. Moir has proposed to take up all, but to devote special attention to three of the largest and most important "perimeters." It would seem that after all only some 80 or 90 small hamlets would have to be interfered with.

The reason why the perimeters are extensive is, that the *Chos*

branch exceedingly. If any one riding along the district road, which we described at the outset of this article, turns northward, up the bed of the *Cho*, he will find that after he reaches the foot of the lowest spurs of the hills, the bed will branch off at once into several torrents; and if he follows up one branch, he will find that that again branches, till at last he traces one branch up to a narrow gorge through which he can hardly pass (vide "Indian Forester," Vol. V., page 16), and reaches a sort of basin or amphitheatre of broken sand hills, which is the source of the branch: this basin together with the continual abrasion and cutting down of the miles of sand stone (half hardened) through which the *Cho* cuts, are the source of the loose sand which is carried down over the plains.

It is essential of course, as Mr. Moir points out, to begin at the top; it is of little or no use to try and restrain the edges of the bed in the plains, where new masses of material are continually sent down year by year, from above. We must endeavour to stop the supply of sand material at the fountain head. Hence, while our mainstay must be the encouragement of vegetation *in all forms*, on the friable surface, it may greatly facilitate and expedite the work to have recourse to *fascines*, and other devices of an engineering nature. In our opinion the partial levelling of large tracts, so as to get them into an unbroken though crested and undulating extent. A work known as *encrêtement* in the Alps, will be of immense service, and such areas covered with grass and herbage, will at an early date be available for the support of the cattle which must be kept out of the perimeters generally and will be always a source of trouble.

It cannot be too clearly borne in mind however, that official fears of oppression and of worrying "the people," have *very greatly and persistently* exaggerated the amount of removal and repression needed. After a very short time, but after the clothing of grass and herbage has been secured on decently levelled and accessible tracts, the Forest Department could easily arrange to maintain the whole number of cattle (camels of course excluded) which are now such an object of anxiety. In the Alps by the establishment of *fruitières*, both fodder plants and roots are raised, as well as supplies of grass and other seed for the express purpose of sowing pasture grounds, at and about which the cattle can be collected, while the closed areas are allowed to rest.

It is needless almost to point out, that the fact that cattle are not so numerous as to be unmanageable, has nothing to do with the necessity for closing. For when a tract is very much denuded, a small number of hungry cattle grubbing up every stock and gnawing at every sparse attempt at vegetation, are quite sufficient to *prevent* the re-growth required; and that is the important matter.

The Government orders on the report are not very encour-

aging: but they contain one good feature, they admit the idea of special legislation: all that we can add is to point out, how absolutely reasonable it is to recognize, that in curing a great evil, the few must suffer *some* inconvenience for the saving of the many. What, as Mr. Ribbentrop puts it, is the justice of allowing "785 villages to suffer so that 80 Gújar hamlets may pick up a precarious living"? There should be no hesitation about re-appropriating for the public benefit, the whole range, and providing that while a fair compensation is paid for actual cultivation (regard being had to its precarious nature) and for buildings, no other compensation shall be allowed for temporary loss of rights, provided that when the Forest Administration declares the perimeters *défensable* or safe, the quondam owners of the "waste" shall have such regulated rights of grazing and wood cutting as shall be consistent with the permanent maintenance of the forest area. It should not be forgotten as a very important element in the calculation, by those who are apt to talk about 'confiscation' and so forth, that the restoration of the area itself (apart from the public benefit to the lower lying properties) will render the rights ultimately given, *far* more valuable than the *nuda proprietas*—the bare ownership of the desolate hills now is.*

MADRAS AGRICULTURAL ESSAYS.

THE Report of the Madras Agricultural Exhibition, a copy of which has been sent to us, contains in addition to the usual information as to exhibits, prizes, attendance, &c., the best of the essays submitted to the Committee by private competitors. Two essays are published on the management of soils under coffee in Southern India, four on the best and most economical methods of utilising irrigation water, and two on the best method of laying down fuel plantations in India. The essays on coffee soils are interesting as far as they go, but they are more or less incomplete. Both authors insist strongly on the importance of good manure, and in Mr. Clarke's essay stress is very rightly laid on the fact that soils under coffee owe the diminution of their fertility far more to loss by waste than to the removal of material in crop. The Author points out that if the soil is to be kept in a fertile condition this loss by waste must be prevented, and he shows that such a process, although necessarily expensive, can with care be made profitable. He urges that organised experiments should be made to elucidate

* That is, moreover, conceding that there *is* a real ownership; for the Settlement Report throughout says nothing on the subject. All that is known is that the "waste" was shown as included in the village boundary, without any special orders on the subject, and it is very much a *matter of opinion* and of vague *feeling* that has gone on gathering from one later report to another, whether any proprietory right was *really* given at all.

the best available methods by which this can be done, and emphasises the necessity for rigid economy and scientific knowledge of coffee cultivation under its present conditions is to be carried out with profit. The essays on Fuel Plantations are of very general interest, and we particularly commend that submitted by Mr. Rhodes Morgan. It is obvious that fuel plantations if carefully conducted must of necessity be profitable, for the demand for fuel is probably everywhere on the increase, and a plantation when once fairly started is little liable to damage from excessive or insufficient rainfall. The best tree for fuel plantations is said to be the *Casuarina muricata*, which easily adapts itself to climatic variations, grows with great rapidity, and moreover yields timber capable of bearing a very high cross-strain. After securing a plot of suitable land near the market where the wood is to be sold and easily irrigable, Casuarina plantations can be laid down by sowing the cones in shallow rows. The seedlings should be planted out when 9 inches high, and for 100 acres of land about 1½ lakhs of plants should be laid down in the nurseries. The seedlings should be well watered up to the time of transplantation, and after transplantation the watering should be continued until the young trees are in vigorous and steady growth. A seven year old Casuarina tree averages 60 feet in height and 30 inches circumference near the ground. The price of seedlings is given at Rs. 6 per 1,000, and 1,200 or 1,500 to the acre should be allowed. Pitting the ground costs about Rs. 8 per acre, and watering about Rs. 26. Fencing, quit rent, and miscellaneous charges bring up the total cost per acre to Rs. 64. An eight year old tree contains on average 10 cubic feet of wood, and supposing 1,000 trees per acre to survive, 10,000 cubic feet of wood would be produced, the weight being 267$\frac{6}{7}$ tons. At Rs. 8 per ton this would realise Rs. 2,142-13-8. Interest charges, felling, sawing, carting and supervision bring up the total expenditure to Rs. 842-8-5 per acre, and the net profit is Rs. 1,300-5-3. Other good fuel trees are the *Acacia arabica*, the *Albizzia lebbeck*, which also produce good timber, and the list could be easily enlarged. It should be remembered that *Casuarina* grows best in light sandy soil, and if any part of a block of land intended for a fuel plantation should be found of stiff cotton or clay soil, some other species of tree should be laid down. In a fuel plantation the coppice system should be followed, *i. e.*, each portion of the block should be felled completely in rotation. The stools will shoot up freely and regularly, but the outturn will be slightly less than that of the first cutting. After three or four coppicings have been effected the land should be replanted with another species of tree, whenever this is possible. But on sandy soils the *Casuarina* is so far superior to other trees that it is better to let well alone, and not attempt to lay down new varieties.

In hill climates such as that of the Nilgiri Hills, the best trees for fuel purposes are those imported from Australia, the Acacias *Melanoxylon* and *Dealbata*, and in particular the *Eucalyptus globulus*. Mr. Morgan states that were the many acres of grass land in the neighbourhood of Ootacamund planted with a mixture of these trees, they would afford an abundant and perpetual supply of fuel more than sufficient to meet all possible requirements. A fuel plantation in the Nilgiris laid down with wattle trees would be fit for felling in 7 years, and would produce a net profit of Rs. 664 per acre, the price of fuel being calculated at Rs. 8 per ton. A plantation of *Eucalyptus globulus* would probably stand five or six septennial fellings without diminution of outturn, and might even last longer than this. Decennial fellings would be more profitable, the net gain per acre on such coppicing being given by Mr. Morgan at Rs. 2,043. In the case of a 500-acre block of mixed natural jungle worked carefully and within easy reach of the fuel market, the net profit for 12½ years is estimated at Rs. 3,03,800, being at rate of Rs. 607 per acre.

The exact amount of calorific power of any given tree is difficult of calculation, but may be said to increase with density and hardness of the wood. Resinous and oily woods are of little value as fuel, but most hard woods burn with a clear fine flame, and produce excellent charcoal, which may profitably be manufactured in fuel plantations. Mr. Morgan's interesting essay closes with some practical remarks on the enemies and diseases to which plantations are exposed, and the best means for their extermination.

III. Official Papers.

REPORT ON LOCUSTS.

From—Frederic Moore, Esq., *late Assistant Curator, India Museum, London. To—The* Under Secretary *of State for India.*

Sir,—With reference to your letter of the 9th October last (R. S. & C., No. 2046), and its accompanying packages containing specimens of locusts from the Bombay Presidency, which were forwarded to me with the view of determining their scientific names, I have the honour to forward the following brief report thereon.

The specimens of locusts sent from Purandhar are representatives of three species, referable to the genera of *Acridium* and *Caloptenus*, and of which the following descriptions will serve for future identification :—

(1). *Acridium succinctum.* Front wings yellowish olive-brown, with broad darker brown streaks from the base between the middle veins, these streaks becoming slender and obliquely disposed toward tip of the wing. Hind wings pellucid, bright purplish-rose colour towards the base. Body and legs olive-brown. Head smooth, with transverse blackish marble streaks ; face keeled, black streaked, and with a yellow bead-like spot at upper end of outer keels, and a similar spot between the inner keels. Eyes oval, olive-yellow, black streaked. Antennæ yellow. Thorax roughly punctured, and with a slight dorsal keel, a blackish sub-dorsal streak, and a broad lateral front streak with a pale central streak. Abdomen brown. Front and middle legs olive-brown above, yellowish beneath. Hind femora nearly as long as the body, pale testaceous, tip sap green ; hind tibiæ olivaceous, spines white with black points. Expanse of the wings four-and-a-half to five inches.

(2). *Caloptenus erubescens.* Front wings reddish testaceous at the base, and pale brownish towards the tip, marked with numerous dark brown transverse streaks between the upper veins, the streaks being broad and macular from the base of the middle veins, and then becoming transversely continuous towards the tip. Hind wings pellucid, pale purplish-rose colour towards the base. Body and legs testaceous. Head and prothorax with a broad indeterminate blackish stripe on each side. Head smooth, moderately long, tip of the vertex and front punctured,

transversely sub-elliptical, distinctly keeled, inner keels parallel, outer keels diverging slightly towards the face. Eyes elliptical, ferruginous. Antennæ slender, pale, testaceous. Prothorax finely punctured, with an extremely slight middle keel and hardly perceptible lateral keels, transverse impressed line straight, fore border and sides slightly rounded, hind border much rounded. Prosternal spine very thick, not attenuated towards the tip, which is slightly truncated. Hind femora nearly as long as the abdomen, with a black longitudinal stripe along the outer side, and three strips along the upper part of the inner side ; hind tibiæ pale testaceous, shorter than the femora, the spines with black points. Front and middle legs testaceous. Expanse of the wings nearly two inches and a half.

(3). *Caloptenus caliginosus.*—Body and legs dark brown. Front wings brownish-ochreous, with large, broad, dark brown spots from the base, and smaller transverse spots towards the tip. Hind wings pellucid, slightly suffused with pink at the base. Head with pale ochreous streaks. Face keeled ; the edges of the keels pale ochreous. Eyes oval, brown, with pale ochreous streaks in front. Antennæ ochreous. Thorax above scabrous, punctured at the sides ; top and sides keeled ; the edges of the keels pale ochreous ; a black spot with ochreous centre on each side. Abdomen dark brown, with ochreous segmental bands. Hind femora very broad, dark brown, paler beneath, the ridges on outer side prominent, upper ridge with short black spines, the latter ridges spotted alternately with black and ochreous, tip black streaked, inner side paler, with a broad black streak along the middle ; hind tibiæ pale brownish-ochreous, with black tipped spines. Front and middle legs ochreous-brown. Expanse of the wings two inches and a half.

The specimens forwarded from Násik and Sholápur are also referable to the species No. 1 above described, namely, *Acridium succinctum.*

Those from Sirur Táluka (referred to in letter from Revenue Department, No. 71, dated 4th September, 1883,) are quite different from either of the above, and are representatives of the species of the genus *Cyrtacanthacris*, namely,—

(4). *Cyrtacanthacris ranacea.*—Front wings olivaceous brownish-ochreous, with two large well defined dark brown basal spots, followed by an inward oblique constricted spot, a lengthened spot, and thence to the tip by several outwardly oblique short spots. Hind wings pellucid, yellowish. Body and legs olivaceous brownish-ochreous. Head smooth. Eyes brown. Face slightly punctured, keeled, the bead-like spots facetted. Thorax numerously covered with minute raised tubercles on the top, and punctured at the sides, with a whitish dorsal streak and lateral quadrate spot, the latter blackish along its upper edge. Hind femora with dark brown ridges and transverse streaks ; tip

black ; tibial spines long and black tipped. Front and middle legs brownish-ochreous. Expanse of the wings four and three-quarter inches.

Any papers containing reports of the occurrence of locusts, or other insect pests in India, that I could be favoured with, would greatly interest.

110, Oakfield Road, Penge, London, S.E.,
12th November, 1883.

From—FREDERIC MOORE, ESQ., *late Assistant Curator, India Museum, London. To*—SIR G. M. BIRDWOOD, C.S.I.

SIR,—In continuation of my remarks upon the specimens of locusts, referred to in letter R. S. & C. No. 2046 of 1883, forwarded from Bombay, which were sent to me for examination and the identification of their scientific names, I have the honour to submit the following note upon Dr. Macdonald's letter, No. 502, dated Bombay, 22nd October, 1883, and which were subsequently also sent to me for the same purpose. The object for which these specimens of locusts have been forwarded to England being simply for the purpose of ascertaining their scientific names, my examination of them results only in supplying that information.

The specimens contained in the nine small bottles, with the exception of the single specimen noted at the end of paragraph 2 of Dr. Macdonald's letter are all representatives of one species of the family of *Acrididæ*, namely, *Oxya furcifera*, and of which the following is a description for future identification.

Oxya furcifera.

Adult.—Grass green, head smooth at the sides, and with a few slight strigæ above ; face broad, punctured, with four keels, two central and one lateral, a small bead-like spot between the middle keels and a similar spot on each lateral keel above the antennæ ; vertex prominent, depressed above, convexly angular in front ; eyes brown, lateral, remote, prominent, oblique ; antennæ ringed with black ; thorax very finely punctured, traversed by four transverse slender black striated lines, the two posterior lines extending to near the lateral edge, third line short, dorsal, the anterior line interrupted above ; abdomen brown along the dorsal keel. Hind femora long, extending to end of the abdomen, ridged above and beneath on both sides, laterally thickened to the base and with transverse angular strigæ ; knees black streaked ; hind tibia nearly as long as the femora, bluish, with two rows of strong black-tipped spines above and four single spines at the end ; tarsal pads large ; fore and mid legs slightly punctured ; tibiæ slightly spined beneath. Front wings

grass green, reticulated ; hind wings pellucid, reticulated, prominent veins brown towards the base.

Expanse of wings, male 2, female 3, inches.

The reported statement at the end of paragraph 3 of Dr. Macdonald's letter, that *immature* pairs of these locusts breed, cannot be true. The act of perpetuating the species cannot be effected before the insects have reached the adult stage. The eggs contained in the abdomen of the female are formed during the pupal stage, and are not susceptible of fecundation during that stage of the insect's life. The eggs, noted as having been actually laid by an *immature* female, whilst confined in a box, were only exuvial pellets.

31st December, 1883.

INSTRUCTIONS HOW TO PRESERVE PLANTS INTENDED FOR IDENTIFICATION.*

I. How to collect the specimens.

If the plant is small, that is, if it is not more than 18 inches by 13 inches, pick the whole of it, taking special care that it exhibits well the *leaves*, *flower* and *fruit*.

If the plant is a shrub or a tree, take a branch with at least two leaves attached to it. Take also a branch which bears the flowers. If the flowers are very large or fleshy, some additional ones may be dried separately.

N.B.—It is most important to remember that for proper identification it is absolutely necessary that all the different parts of the plant should be well shown, especially the *leaves*, *buds*, *open-flowers* and *fruit*.

II. How to dry the specimens.

Take a board 18 inches by 13 inches, and place upon it four sheets of thick unglazed paper (any common country paper will answer the purpose), and place the specimens which have been selected, as directed above, upon the paper, so that they shall not touch each other.†

On these specimens place four more sheets, and on the sheets more specimens, and then again more paper. This may be repeated a number of times varying according to the thickness of the specimens.

On the top of all place a second board, and on this board a weight, which shall equal that of about twelve ordinary sized bricks.

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* Issued by Director of Agriculture, Madras, for guidance of officers sending specimens.

† Mr. Mann used iron wire frames in Assam, which are far better than boards, allowing moisture to pass off most readily ; similar ones are now used at the Forest School, and may be obtained from the Canal Foundry, Roorkee.—[ED.]

After the plants have been under pressure for *not more* than twenty-four hours remove the paper, which will be found to be quite damp, and replace it with other quite dry paper, and put them again under pressure.

Repeat this changing of the paper daily for a week or until the plants are quite dry.

N.B.—The damp paper may be dried in the sun or over a fire, and may be used over and over again.*

III. How to pack the specimens when dried for despatch by post.

When quite dry the specimens may be packed as in the press, only with one sheet between each layer of specimens instead of four, and that sheet may be quite thin. Ordinary newspaper will do.

The sheets with the plants should then be made into a flat parcel, and as compactly as possible to prevent their shifting, and the parcel should be further protected by card-board covers.

IV. How to preserve specimens which are too fleshy to dry in the way above described.

Take the whole plant entire, or in sections if too large, and place it in a jar or wide mouthed bottle and fill with methylated spirit. Cover the mouth with several folds of *wet* bladder.

The jar or bottle should then be put into a box with a packing of hay to prevent its shifting and despatched by rail.

V. How to direct the parcel or jar.

In order to prevent doubt as to whom the specimens are sent from, it is very desirable that the direction card should bear the name of the specimens and the name and residence of the sender. The accompanying example will explain fully how the parcel or jar should be directed.

Specimens of Kol-naru.

From

A. B., SUB-COLLECTOR OF SOUTH CANARA.

To

M. A. LAWSON, ESQ.,

Director of Government Cinchona Plantations,

Botanical Gardens and Parks,

Ootacamund.

* Or better over burning charcoal.—[ED.]

VI. The specimens should be accompanied by—

I. A description of their general appearance.

II. A description of any noticeable peculiarity.

III. A description of any uses the plant, which the specimens represent, may be made of.

The following examples will show what are the chief points to be attended to :—

Example I.

Specimens of *Kol-naru*—

I. A rather slender shrub, not much branched, sometimes almost a small tree ; bark light grey and smooth.

II. *Flowers* brick-red.

III. *Fruit* not fleshy, spirally twisted.

IV. Grows in the more open jungles on the plains or on the slopes of the ghâts up to 5,000 feet.

V. The natives make cordage and nets from the fibre obtained from the bark.

VI. Specimens of the raw fibre sent by rail.

Example II.

Specimens of *Bodu*—

I. A fleshy plant 6 inches to 1 foot in height, growing singly or two or three together on the roots of the tobacco. In the place of green leaves the stem is covered with brown fleshy scales.

II. The flowers are a rather dull purple.

III. The plant causes much damage to the tobacco crops.

IV. I am told that the natives in some parts use the *Bodu* as fodder for their cattle. I have tried it with cattle here but they refuse to eat it.

V. I have not seen *Bodu* growing on any other plant but the tobacco ; but if I should hereafter I will send dried specimens for identification.

VI. Eighteen specimens have been dried and sent by post. Six other specimens have been put in spirit and sent by rail.

JY. TIMBER MARKET.

MESSRS. MACKENZIE LYALL AND CO.'S CALCUTTA TIMBER MARKET REPORT FOR MARCH AND APRIL.

Rangoon Teak.

Mast Pieces, good large, ...	Rs. 5 to 12 per running foot.	Quotations nominal.
„ „ small, ...		
Sawn Timbers, ...	„ 85 to 115 per ton.	„
Planks, long lengths, ...	„ 120 to 130 „	„
Sheathing Boards, ½-inch,... ...	„ 140 „	„
„ „ ¾-inch,... ...		
Boards, 1 inch, ...	„ 105 to 140 „	„

Moulmein Teak.

Square Timbers, 20 to 30 feet long, 10 to 24 inches square, first class,	Rs. 105 to 135 per ton of 50 cubic feet.			
Square Timbers, 20 to 45 feet long, 14 to 18 inches square,... ...	„ 130 to 200	„	„	„
Second-class Timber, ...	„ 85 to 95	„	„	„
Planks, long lengths, first class,...	„ 120 to 145	„	„	„
Furniture Planks, 18 inches and upwards, and 1 inch thick—good,...	„ 130 to 170	„	„	„
Sheathing Boards, ½-inch, double,...	„ 140 to 150	„	„	„
„ „ ¾-inch,... ...	„ 145 to 160	„	„	„
Scantlings (of sizes), ...	„ 65 to 150	„		
Moulmein Cedar square timber, ...	„ 65 to 80	„		
Peemah (*Lagerstræmia Flos-Reginæ*), ...	„ 60 to 65	„		

Other Timber.

Mahogany,...	As. 5 to 7 per supl. foot of 1 inch thick.
Ash Oars, ...	„ 5½ to 6 per foot.
Sál small, „ large, ...	Rs. 70 to 110 per ton.
Johore Teak Squares, ...	„ 60 to 65 „

V. Notes, Queries and Extracts.

The Cardamom Hills of Travancore.—The night of my arrival at Odumenshola, the elephants were very noisy, and gave us a serenade close to the camp, and another herd about a mile across the valley was evidently troubling the people camped at a Tavalum, or cardamom-collecting station, and tom-toms were beaten and matchlocks fired to drive them off. Our camp was well protected by a deep broad trench, and despite the trumpeting and rumbling growls of the herd, I was able to sleep soundly. A. informed me that elephants often fed close up to the trench, and on one occasion he interviewed a herd with a magnesian light. As long as the light was burning they all stood staring at it (the trench intervening), but on its going out they gave a series of screams, and quickly vanished into the neighbouring jungle. For some nights afterwards they carefully avoided the camp.

I spent several days with A. at Odumenshola, and joined him in his various visits to the neighbouring Tavalum and gardens, as well as on his rounds road making, and I had many opportunities of watching the work of collection and curing the cardamoms. Our ride to a large Tavalum was very interesting as we passed through miles of cardamom forest through which bridle paths had been cut. The Tavalum we visited was some distance beyond the forest, and was a busy scene, as a large amount of cardamoms were being dried on the natural barbacues of rock, and women and children were busy stripping the capsules off the scapes that had just been brought in. From here we rode over a pretty undulating grass country to Callapara, where A. had a large permanent camp for warehousing the cardamoms from the neighbouring forests. This camp as at Odumenshola was surrounded with a trench to keep the elephants out. Previous to the trench being cut, a tusker had, by way of amusement, attacked the bungalow, and despite the efforts of the watchman to drive it away, had damaged a good deal of the verandah before aid came. Near the trench A. pointed out a hill gooseberry or nellikai tree, where a forest tragedy had occurred. The watchman had heard the sound of a sambur, and noticed a large stag steadily facing the grass with his back to the tree as if facing some danger. Presently a tiger sprang on the stag, which received him on his horns, and threw him into the grass, receiving a blow at the same time from the tiger. The stag was seen to lie down, and the watchman going

to see whether it had moved, found it dead. The tiger did not return, and most probably got his death wound, as A., to whom the stag's head was brought, found both brow antlers covered to their bases with blood and tiger's hair. He described the head as the finest he had ever seen. From Callapara we returned to Odumenshola by a pretty bridle path over some miles of open grass country. At a nullah we crossed before rising to the hill on which our camp stood, we disturbed a herd of elephants who from their cleanly appearance had just had a bath in the nullah. Our presence scarcely disturbed them, and they moved off a few yards into a neighbouring bamboo clump, where we could hear them for a long time trampling and crushing the bamboo. A. had some time previously lost a good deal of his baggage here by the attack of a rogue elephant on his coolies. Fortunately for the coolies they had just put down the loads when the tusker rushed among them, and he was too much occupied to notice them crouching in the grass among the cases and packages. Six or seven cases of crockery and provisions were soon smashed up by the rogue, and he would have probably destroyed everything, and hunted the coolies as well but for a case of medicines which disagreed with him and made him beat a retreat. A. came on the scene an hour afterwards and tried to follow him, but he had gone clean off, and his track evidently indicated a great hurry, so A. had to bewail the loss of his goods and chattels without the satisfaction of bringing the rogue to book. Full as the country seemed of elephants (I counted nearly forty in sight at once from our camp) there are many months in the year, I was informed, that they are not to be seen. A. told me they had regular seasons for migrating to the cardamom forests, and that he recognised individuals invariably appearing at the same time every year in what appeared to be well-known runs of theirs. In February they disappeared *en masse* when the hill fires began, and the water was scarce ; to return late in October.

The cultivation of Cardamoms.—I fear I have digressed a great deal from the subject of cardamoms, and must return to my notes. From what I could learn there are two varieties of cardamom in the Travancore forests. One crop comes to maturity about October, and the other in January. The varieties appeared to be caused by difference of rainfall and soil ; the former growing in a misty wet climate and poorer soil than the other, which grows in a comparatively dry climate, and fine rich soil. My small experience was confined to the latter variety. Land having been selected, the Superintendent has to be applied to for leave to open the garden. Nothing is charged in the way of assessment till the garden comes into bearing, when a rate of ten per cent. on the crop is charged for land tax. Only certain forests will grow cardamoms, and the presence of a few wild plants is a safe indication of the suitability of the soil. They will not grow in bamboo or reed jungle, nor

will they thrive under munga-murrum, mella-murrum, or dammer trees. The best aspect is a northern one, and a steep incline is better avoided. The finest gardens I noticed were on easy undulating land, and in such situations I was informed they lasted for years. The opening and preliminary work is very simple. Operations begin in April by the cutting down of all undergrowth to 6 or 8 inches in diameter; and here and there large trees of rapid growth are cut down. No burning is done as in coffee clearings, and the felled branches and undergrowth are allowed to rot. In the following October the young cardamoms begin to sprout. Where they are too crowded, it is necessary to thin them out and transplant them into the open spaces, and where the plants have sparely sprouted, it is also usual to sow the ground with seed. The seed should be sown before the monsoon. The growers prefer stocking their gardens with spontaneously grown plants, which they say last longer and come late, bearing earlier than those grown from seed. For two years nothing further is done. In the third year the clearing should be weeded, and the small sprinkling of crop gathered. In the fourth year a thorough weeding ought to be done, and the decayed stalks and leaves heaped up between the clump of cardamoms. The garden is now in full bearing, and will require regular attention. The weeding should be done in November, and the crop comes immediately to maturity with the letting in of light and air. Cardamoms require light showery weather in March and April, when the flowering scapes are ready to blossom. In rich soil the scapes will run out to 3 and 4 feet in length, but shorter growths give better results in the way of crop. The failure of showery weather immediately after the blossom will ruin the prospects of the crop, and though the scapes will sometimes throw out a second blossom, the result is generally a poor one. The fluctuations of crop are therefore great, and as hail storms often occur about the blossoming time, the risk and uncertainty of crop is much increased. Cardamoms begin to ripen in November, but it is often late in January before the growers will pick the crop, and a great deal is destroyed by snakes, rats and vermin of every description. Judging from what I saw in the garden, of capsule shells, probably one-third is lost in this way. Chetties from the neighbouring villages in the Madura District, are the principal growers, and they usually begin the cardamom harvest when about half the remaining capsules on the scapes are ripe.

The scapes with the cardamoms on are removed to the small collecting stations, and cured by a process of drying in the sun and exposure to the dew. The morning after the collection the capsules are carefully removed from the scapes, and dried on the rocks. The fleshy shell soon loses its green or brown colour under the three or four days drying, and is then fit to be removed to the weighing stations. Cardamoms lose two-thirds,

three-quarters, or even four-fifths of their measure by drying; the exposure to dew is supposed to give a bleached look to the sample. Some cardamoms I noticed had a green tinge which no amount of drying could remove, and was supposed to be caused by the nature of the soil they came from. Could the crop be gathered in, as it ripened, there is no doubt a much better sample could be secured, but I was informed that it would not pay the growers to do this, as the Travancore Government made no distinction in the price for bad or good qualities, and the result was the loss of much of the ripe fruit and the character of the rest being damaged by indiscriminate packing of mature and unripe capsules together. A second curing and winnowing is given at the weighing stations, and there is a further drying and winnowing on the coast when the cardamoms are ready for the buyer. On the coast the best descriptions will realize as much as Rs. 4 per lb. (Dutch), but the grower only receives a third of this, and when all deductions from this third are made for watchmen, land tax and other petty charges, the amount really paid is nearer one-fourth than one-third. From notes taken of the cost of cultivation, I was doubtful whether the growers could make any thing by the transaction, but the fact of their continuing to cultivate is proof that they do make something. A. considered it paid the growers if they secured two good crops to three bad ones; but he admitted that it was very difficult in bad seasons to get the owners to take in their crops, and he had often to do so at the Government's expense. At one time the produce had been as high as 3,000 cwt., but had subsequently dwindled down to a tenth of that quantity. Since A's incumbency more land has been opened up and abandoned gardens brought into cultivation, and he had lately a crop of 1,500 cwt. A more liberal policy on the part of the Travancore authorities would soon double the cultivation. Nearly all the cardamom growers are British subjects, owing no doubt to the fact that the forests as far as the Pereyaur had once been under British jurisdiction. About the second decade of this century, this tract was transferred to the Travancore Government, and the cultivators who were British subjects continued their occupation under the new rule. Roughly estimated about 20,000 acres were under cultivation, and from what I could learn there was forest land enough available for extending the cultivation five fold. The yield per acre in even favourable time does not exceed 20 to 25 lbs. of cardamoms.

In addition to cardamoms the Travancore Government collect ivory, wax, gallnuts and other hill products, and obtain some revenue from teak and blackwood, and also from cattle grazing fees. Altogether the average nett revenue comes to about 2 lakhs of rupees. No land is granted for otherwise than cardamom cultivation—a wise policy on the part of the Travancore Government, as without losing their forests they obtain a safe

though fluctuating revenue. Still there is a good deal of land suitable for grain cultivation which is not allowed to be cultivated though ready with a light tickling of the surface to yield fine crops. The wandering hill tribes in return for Sircar service are alone allowed to grow any grain, and they are restricted to old nursery clearings.

Though the cardamom hills are unoccupied at present by any resident population, there was a time when they must have been inhabited, as ruins of forts, rude carvings, and inscriptions plentifully testify, but there are no traditions of the old inhabitants, and the present hill tribes, according to their own account, are but comparatively recent settlers. The present hill men are of either Tamil or Malayalam origin, and seem to have settled on the hills in the last three hundred years. They are fine men in physique though living in feverish places, and according to census returns are on the increase. The Railway has made the country accessible, as twenty-four hours from the Railway Station of Ammanackenoor would land the sportsmen at some of the finest shikar grounds in Southern India.—*Madras Mail.*

REARING SILKWORMS IN THE CHANGA MANGA PLANTATION.—A correspondent sends some interesting information to the Lahore paper on the rearing of silkworms in the Changa Manga Plantation. He says :—

"Changa Manga is a sissú plantation of 11,000 acres, situated 44 miles from Lahore on the Mooltan Railway line. During the last few years a thick undergrowth of mulberry has sprung up under the shade of the sissú. This is due most probably to the immense number of starlings and other birds that visit the plantation during the time the mulberries are ripe. This undergrowth is encouraged by the Forest officers, in order to cover the ground from the hot rays of the sun during the summer, and to keep down the dense growth of coarsé *kaṇa* grass, which springs up during the rainy season. There are now several hundred acres of this mulberry undergrowth; and Mr. Ribbentrop, Conservator of Forests, suggested that it might be utilized in rearing silkworms. Mr. Lemarchand, Deputy Conservator of Forests, was accordingly deputed to the Gurdaspur district to collect all the information necessary on the subject, and to start the scheme at once. Twelve chittacks (24 oz.) of Japan eggs were obtained from Mr. Keighly, of Madhopur, in February last. During March the worms began to appear; and now they cover a space of nearly 1,300 square feet, packed close together. There are at present four rearing sheds covering an area of 2,000 square feet. This is insufficient, and more sheds are being built. So far, the experiment has proved a great success; and it is well worth any one's while to run down from Lahore to see what is being done; Changa Manga is only a two hours' run from Lahore, and it is the largest sissú plantation in India, besides being the prettiest spot in the district."

* * * * * *

The Forestry Department in the Punjab is thus bestirring itself in the growth of the mulberry plant, an undergrowth of which is said to extend over an area of 12,000 acres of sissú plantation on the Lahore and Mooltan railway, and to utilise these, an abundant supply of the best variety of silkworm eggs has been procured, large breeding sheds have been erected, and there is every prospect of an extensive industry growing up. Let the Punjab authorities however, remember that to rear the worms and obtain a supply of cocoons are not sufficient to ensure the complete success of this industry. Great care and attention must be given to the winding-off the silk, for if this be done carelessly all previous labor will have been in vain. It is in this that the natives of Bengal have so completely failed, to the depreciation of Bengal silk and the decay of the trade in the article; and it was this same negligence and indifference to their own interests which ruined the hand-loom industry in jute 30 years ago, and compelled the shippers of gunny cloth and bags to introduce machinery for spinning and weaving, in substitution of hand labor.—*Indian Agriculturist.*

GUINEA-GRASS AND LUCERNE.—The following is from the Proceedings of the Agri-Horticultural Society of India, and we are very much obliged to the Secretary, Mr. Blechynden, for his corrections to our correspondent's paper :—

An article under the above heading, appeared in the correspondence columns of the "Indian Forester" for March, in which it is stated that guinea-grass was "introduced into India apparently not much earlier than 1870, in which year it was cultivated at the Madras Experimental Farm." On reference to the Society's Journal it will be found that the introduction of guinea-grass into India attracted the attention of the Society in 1836, some 34 years before its cultivation at the Madras Farm; and in the correspondence which ensued Mr. John Bell, the then Secretary, mentions that he had cultivated the grass with success in 1831, and subsequent years. In 1837, four prizes were offered by the Society, ranging from Rs. 200 and a gold medal, for the best guinea-grass cultivation of 20 bigahs, to Rs. 50 for 20 seers of guinea-grass seed. In 1838, mention is made of the grass succeeding in Azimgarh, Hissar, Cawnpore, Beawur and Coel, wherever the last named two places may be, about two maunds of seed having been distributed in that year. In 1848 a curious paper on the cultivation of guinea-grass was forwarded to the Society, and will be found in Vol. VI., it was apparently published in Calcutta originally, in 1793, dedicated to Sir William Jones. The directions given are clear and concise.

THE following rules for silos are taken from the "Englishman"

in a paper on the recent very successful experiments in Calcutta :—

1*st*.—The sides of silos must be as nearly perpendicular as possible.

2*nd*.—The grass, &c., should be well spread and heavily trampled as it is being filled into the silo.

3*rd*.—The weight on the top of the silo must be at least equal to 200 lbs. to the square foot, which is given by 2 feet of earth or bricks ; and the more imperfect the silo, the more pressure it requires.

4*th*.—And most important of all, the layer of earth immediately over the top of the ensilage must be made as air-tight as possible, by simply working the surface of it into mud and plastering this down. The primary layer need not be more than four or five inches thick : if earth is difficult to get, the remainder of the weight necessary may be made up with anything that is dry.

A silo may be filled with any number of different kinds of green forage, and this may be leisurely done in two or three days, but the quicker it is done the greener and fresher will be the ensilage. In opening a silo for use, remove as little of the weight as possible, as the pressure prevents the air from penetrating far into the mass.

CASHAW (*Prosopis juliflora*).—The following extract from the last report of the Agricultural Horticultural Society of India is interesting :—

A parcel of this seed has been received from Mr. D. Morris, Director, Botanical Department, Jamaica, as well as seeds of *Gouania domingensis*, *Cassia Fistula*, *Calyptronoma Swarzia*, *Cassia obovata* :—

Mr. Morris writes as follows :—

"I beg to forward herewith seed of *Prosopis juliflora*, known here as 'Cashaw,' which is an admirable tree (often attaining a height of 40 to 60 feet) to grow in dry gravelly soil, and in situations where rain does not fall for months together.

"It is fast growing : the timber is excessively hard and of a remarkably durable character. It is used for making knees of boats and all work requiring strength and tenacity. Posts of 'Cashaw' in wire fences last longer than any other, and are in great request for that purpose. Kingston is supplied annually with hundreds of tons of Cashaw, which is the only firewood immediately accessible.

"The pods are of a sweetish succulent character eagerly sought for by cattle : indeed in some parts of this island during droughts they subsist largely on them. For horses and mules the pods are also admirable food, but I would add that in their case it is very undesirable to allow them to feed upon the pods immediately after they have been exposed to rain, as ill effects have been

known to arise from the partially germinated seeds being taken into the stomach, causing great pain and not unfrequently death; this last occurence, however, is so rare that it need not enter into the calculations of the planter. The tree fruits during dry weather when there is little probability of rain, and if the pods are collected and stored in a dry place they will be ready at hand in a sound state for all forage purposes. When thus stored, the pods, instead of being given whole are often broken up or ground, when they answer admirably instead of corn, oats, &c."

THE common Forest Trees of the Adirondacks are the American linden or basswood, sugar maple, black sugar maple, red or swamp maple, black cherry, beech, ironwood, cherry birch, yellow birch, paper or canoe birch, American aspen, large-toothed aspen, white pine, red pine, black spruce, white spruce, hemlock, balsam, fir, larch, white cedar. The above are more or less common. The following are rare, or occur only along the borders of the wilderness: locust, white ash, black ash, elm, slippery elm, butternut, swamp hickory, three species of oaks, balsam poplar, pitch pine, and juniper. As the Adirondack forests are attracting considerable attention at present, says the *Lumber World*, an enumeration of their trees is not perhaps out of place.—*Timber Trades Journal.*

MATCHES.*—IT would more than repay a day's sojourn at Jonkoping, says the *Pall Mall Gazette*, to visit the factory whence proceeds not a small part of the light of the world. The latest novelty, only at work for about a month, is an enormous engine, which daily produces 1,000,000 boxes of Swedish matches. This wonderful machine receives the raw material, namely, blocks of wood, at one end, and, after a while, gives up at the other the matches neatly arranged in their boxes, ready to be despatched to the uttermost ends of the world. The wood which in the course of last summer was brought over to Jonkoping to be made into matches filled twenty steamers and eight sailing vessels.—*Timber Trades Journal.*

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* Cannot some attempt be made to start a match manufactory in India, where so much refuse wood is available, as in our Hill Forests.—[ED.]

VI. Extracts from Official Gazettes.

1.—Gazette of India—

Nil.

2.—Calcutta Gazette—

The 9th May, 1884.—Mr. F. B. Manson, Deputy Conservator of Forests, whose services were, in the notification dated the 17th September, 1883, placed at the disposal of the Conservator of Forests for special duty, assumed charge of the Hazaribagh Forest Division from *Mr. R. L. Heinig,* Officiating Assistant Conservator of Forests, on the afternoon of the 29th December, 1883.

The following postings of officers are sanctioned from the 1st April, 1884, with effect from which date the forest charges hitherto known as the Palamow, Hazaribagh, and Singhbhoom Forest Divisions are grouped together, and will form the Chota Nagpore Forest Division:—

Mr. F. B. Manson, Deputy Conservator of Forests, to the charge of the Chota Nagpore Forest Division, retaining charge of the Hazaribagh Forest Sub-Division of that Division.

Mr. C. J. G. Lillingston, Assistant Conservator of Forests, to the Palamow Sub-Division.

Mr. R. L. Heinig, Officiating Assistant Conservator of Forests to the Singhbhoom Sub-Division.

The 12th May, 1884.—Mr. F. B. Manson, Deputy Conservator of Forests of the 4th grade, in Bengal, is appointed to act in the 3rd grade of Deputy Conservators, during the absence, on furlough, of *Mr. A. J. Mein,* Deputy Conservator of Forests of the 3rd grade, in Assam, with effect from the date on which this officer availed himself of the one year's furlough granted to him by the Chief Commissioner of Assam.

The 13th May, 1884.—Mr. G. W. Strettell, Deputy Conservator of Forests, Sunderbuns Division, is granted furlough for three months on medical certificate, with effect from the 8th instant, or such subsequent date as he may avail himself of it.

Mr. W. M. Green, Officiating Deputy Conservator of Forests, is transferred from the Chittagong to the Sunderbuns Forest Division.

Mr. R. H. M. Ellis, Deputy Conservator of Forests, on furlough, is posted to the charge of the Chittagong Forests Division.

The 17th May, 1884.—Mr. R. L. Heinig, Officiating Assistant Conservator of Forests, Singbhoom Forest Sub-Division, is allowed three months' privilege leave, under Section 138, Chapter X. of the Civil Leave Code, with effect from the 15th May, 1884, or any subsequent date on which he may avail himself of it.

Mr. F. B. Manson, Deputy Conservator of Forests, Chota Nagpore Forest Division, will hold charge of the Singbhoom Forest Sub-Division, in addition to his other duties, during the absence of *Mr. Heinig*, on leave, or until further orders.

3.—NORTH-WESTERN PROVINCES GAZETTE—

No. $\frac{1121}{\text{II-281-4.}}$.—*The 19th May, 1884.—Mr. M. H. Clifford*, Assistant Conservator of Forests, 3rd grade, to be Assistant Conservator of Forests, 2nd grade, with effect from the 18th October, 1882.

No. $\frac{1126}{\text{II-373-2.}}$—*Mr. A. G. Hobart-Hampden*, Assistant Conservator of Forests, 3rd grade, to be Assistant Conservator of Forests, 2nd grade, from the 18th October, 1883, the date on which he passed in Hindustani by the Lower Standard.

4.—PUNJAB GAZETTE—

No. 227.—*The 5th May, 1884.*—The following officers of the Forest Department have passed the Departmental Examination in Land Revenue :—

Mr. A. M. Reuther, with credit.
Mr. L. G. Smith.
Mr. J. E. Barrett.

No. 228.—The following officers of the Forest Department have passed the Departmental Examination in Forest Law .—

Mr. A. M. Reuther.
Mr. L. G. Smith.
Mr. E. Murray.
Mr. J. E. Barrett.

5.—CENTRAL PROVINCES—

No. 2272.—*The 10th May, 1884.*—Consequent on the retirement from the service of *Mr. J. Macpherson*, Deputy Conservator of Forests of the 3rd grade, the following permanent and temporary promotions are made with effect from the 11th March last :—

Mr. W. P. Thomas, Deputy Conservator of Forests of the 4th grade, in the Central Provinces, and officiating in the 3rd grade, is confirmed in the 3rd grade.

Mr. G. F. Prevost, Assistant Conservator of Forests of the 1st grade in Berar, and officiating Deputy Conservator, is appointed to be a Deputy Conservator of the 4th grade.

Mr. G. F. Taylor, Assistant Conservator of Forests of the 2nd grade, in the Central Provinces, and officiating in the 1st grade, is confirmed in the 1st grade.

Mr. L. A. W. Rind, Deputy Conservator of Forests of the 4th grade in Berar, is appointed to officiate until further orders in the 3rd grade of Deputy Conservators.

Mr. W. King, Assistant Conservator of Forests of the 1st grade, in the Central Provinces, is appointed to officiate until further orders as Deputy Conservator of Forests of the 4th grade.

6.—British Burmah Gazette—

No. 9.—The 22nd April, 1884.—Under the provisions of section 50, Chapter V. of the Civil Leave Code, *Mr. J. Adamson*, Deputy Conservator of Forests, is granted 10 months' furlough to Europe, with effect from the 1st July, 1884, or the subsequent date on which he may avail himself of it.

7.—Assam Gazette—

Nil.

8.—Mysore Gazette—

No. 23.—Mr. J. Stephens, Sub-Assistant Conservator of Forests, Hassan, is granted six weeks' privilege leave from such date as he may avail himself of the same.

Mr. K. Prahlada Rao, Forest Probationer, Bangalore, is placed in charge of the Sub-Assistant Conservator's office, Hassan, during the absence of *Mr. Stephens* on leave, or until further orders.

9.—Madras Gazette—

The 14th May, 1884.—Mr. P. M. Monteiro, Forest Ranger, 5th grade (on probation), South Canara District, is granted one month's privilege leave (on medical certificate), under Section 138, Civil Leave Code, from the date of availing himself of the same.

The 19th April, 1884.—Mr. A. Goudie, Temporary Forest Ranger, Godávari District, on leave, is transferred to the Kistna District for employment in the new Ballamkonda Range.

The 21st April, 1884.—Shaik Tippu Saib, Forest Ranger, Cuddapah Range, is granted six weeks' extension in continuation of the one month's leave without pay granted to him in Office Order No. 1 of 1884-85.

During his absence the arrangements made already will continue.

10.—Bombay Gazette—

The 12th May, 1884.—Mr. W. G. Clabby, Acting Sub-Assistant Conservator of Forests, reported himself for duty to *Mr. A. D. Wilkins*, Divisional Forest Officer, South Thána, on 21st April, 1884, before office hours, with reference to

Government Resolution No. 2953, dated 7th April, 1884, Revenue Department.

No. 4079.—*The 21st May, 1884.*—*Mr. F. S. Menezes*, Sub-Assistant Conservator of Forests, Kánara, Southern Division, was granted extension of leave of absence on medical certificate from 15th July, 1882 to 14th August, 1882, both days inclusive.

NOTICE.

The Editor regrets the unavoidable delay in the publication of this Number, due to his being out in camp away from postal communication.

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